COMPLEX SOCIETIES, LEADERSHIP STRATEGIES AND AGRICULTURAL INTENSIFICATION IN THE LLANOS OF CASANARE, COLOMBIA.

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This research aimed to document the political and economic strategies pursued by emerging elites in the Casanare region of the Orinoco drainage in the Llanos zone at the foot of the Andes of Colombia. A comparative perspective with the complex societies from the Llanos of Barinas in Venezuela offers the analytical basis for the study of the variability in the forms of leadership, demographic scale and social organization between the societies of the Llanos.

The fieldwork on which the study was based consisted of a pedestrian regional survey of 220 km^2 that combined two sampling strategies. A total of 14 archaeological sites were recorded in the bancos and high alluvial floodplains. Six of these sites were nucleated villages which range in size between 5 ha and 12 ha. In some of the largest villages, one or two small mounds were constructed expressing an incipient spatial distinction between people living in the mounded areas and the rest of the population. The concentration of considerable amounts of fine ceramics, lithic artifacts made of imported chert and faunal remains suggests elite or special communal activities around the mounds. In the study region, approximately 500 ha were covered by agricultural raised fields similar to those recorded in other regions of the South American lowlands. Their extent and location suggests that they were worked at small scale based on the labor of a few families.

The complex societies from the Llanos of Casanare emerged between 1000 and 1600 A.D., and were small in demographic scale. The emerging leaders in these communities obtained status and prestige based on the investment of family labor in raised field agriculture which provides the economic basis to support feasting and middle-distance exchange of chert. Although warfare was present in the region, it was not endemic, frequent, or intensive. This characterization suggests that the emerging elites in Casanare were not exploitative in nature unlike the elites of Barinas. These findings make it possible to study the causes and consequences of the multiple factors affecting the emergence and different types of leadership in the Llanos of the Orinoco.

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PREFACE

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1.0 INTENSIVE AGRICULTURE AND THE EMERGENCE OF STRATEGIES FOR LEADERSHIP

Intensive agriculture is often argued to be important to aspiring elites for mobilizing a surplus to use in furthering their own political aims (Clark and Blake 1994; Drennan 1988; Earle 1997; Gilman 2001; Johnson and Earle 1987; Morrison 1994; Stone 1996). For instance, archaeologists have argued that in regions such as Hawaii, Titicaca Basin, Spain, Maya lowlands, Yaguachi, Iruyañez and the Sabana de Bogotá, the construction of agricultural facilities such as raised fields and drainage systems in order to produce agricultural surpluses was related to the emergence of hierarchical social organization (Boada 2006; Delgado 2002; Earle 1997; Gilman 2001; Kirch 2006; Lucero 2006; Spencer 1993; Stanish 2006; Walker 2004).

Top-down models see intensification as a result of elite organization and management (Boada 2006; Delgado 2002; Earle 1997; Gilman 2001; Kirch 2006; Kolata 1983; Spencer 1993; Stanish 2004, 2006). From this point of view, farmers will not generate surplus unless they are forced to, and the construction and management of works of agricultural infrastructure (such as canal systems or raised fields) requires coordination from above. Top-down models are often said to restrict agency to elites while commoners remain passive (Erickson 2006; Scarborough 2006; Thurston 2006). The bottom-up view, on the other hand, sees small farming communities as capable of creating intensive agricultural systems and generating surpluses on their own

(Erickson 1993, 2006; Scarborough 2006; Thurston 2006; Walker 2004). A third approach suggests that neither top-down nor bottom-up interpretations are adequate to account for the variability of agricultural intensification, which responds to changes in the sociopolitical and economic context through time (Janusek and Kolata 2004). The perspective adopted in this research does not depend on the argument that infrastructure for agricultural intensification cannot be created bottom-up without administrative coordination. Nor does it assume that the mere presence of intensive agriculture demonstrates top-down elite exploitation. It is based on the simpler idea that agricultural intensification *can*, under the right circumstances, present aspiring elites with an opportunity to mobilize resources to fund their political activities.

1.1 MODELS FOR LEADERSHIP EMERGENCE AND AGRICULTURAL SURPLUS INVESTMENT

The channeling of surplus production is fundamental to the development of chiefly hierarchies (Brumfiel and Earle 1987; Carneiro 1970, 1998; Clark and Blake 1994; Cobb 1996; D'Altroy and Earle 1985, Drennan 1995; Earle 1997; Gilman 1981; Hayden 1995; Morrison 1994; Nicholas 1989; Parsons 1991; Scarborough 2006; Spencer 1993; Stanish 2004, 2006; Stone 1996). One way that such surpluses can be invested is in military expeditions to capture land or labor that can be incorporated into the agricultural production system and/or to capture wealth and gain control over trade routes (Allen 2006; Hayden 2001; Junker 1999; Kirch 1984; LeBlanc 2006; Whitehead 1994). Agricultural surpluses can support specialized warriors not involved in agricultural production and to feed local populations during siege times (Earle 1997; Redmond *et al.* 1999).

Surpluses also could be invested in the labor needed to construct defensive structures such as palisades and fortifications (Arkush 2009; Champion 1982; Spencer and Redmond 1998).

A second way in which surpluses could be used was to support craft specialists who created prestige goods both for elite use and for exchange (Brumfiel and Earle 1987; D'Altroy and Earle 1985; Earle 1997; Gilman 1987; Hayden 2001). The transformation of agricultural surpluses into valuable goods is important because they can be used by rulers as a means to establish long-distance exchange relationships with rulers from other regions (Brumfiel and Earle 1987; Cobb 1996; D'Altroy and Earle 1985; Earle 1997; Halstead and O'Shea 1982; Junker 1999; Shennan 1982; Steponaitis 1991). Restricted access to foreign wealth goods is necessary for elite purposes because this connects such goods to social differentiation (Cobb 1996). The consumption of prestige items obtained through long-distance exchange allows elites to distance themselves from commoners and represents their status and prestige in terms of the objects that they possess (Cobb 1996; Shennan 1982).

A third way in which elites could put surpluses to work to further their political aims is by supporting craft specialists producing goods for widespread local use. The exchange of food surpluses for craft goods in areas of ecological diversity can be a good strategy for buffering risk (Halstead and O'Shea 1982: 93-94). In areas of resource uncertainty, the exchange of agricultural surpluses allows the redistribution of scarce resources, in this way, people can convert agricultural surpluses into craft goods or vice versa as a means of social storage (Brumfiel and Earle 1987; Halstead and O'Shea 1982). Agricultural surpluses also can be directed to support craft producers of luxury goods (Hirth 1996). Full-time specialization is only possible if there are

the reliable surpluses to supply the specialist producers with subsistence goods and craft materials (Brumfiel and Earle 1987). The valuable goods produced by specialists can be used by elites as a means of payment to local supporters and also as a means of creating intragroup social differentiation, ranking and social obligations (Brumfiel and Earle 1987; Hayden 2001; Stanish 2004). Elites can supply their own people with exotic objects, alcohol, textiles, fancy pottery, tools, and the like as a way of providing benefits to their supporters (Stanish 2004).

Feasting is a fourth alternative strategy in which the elite can use agricultural surpluses to promote their own interests (Clark and Blake 1994; Dietler 2001; Dietler and Hayden 2001; Hayden 2001; Junker 1999; Spielmann 2002). Feasts are very costly in terms of resources and labor, and thus can be co-opted and subverted by aggrandizers into mechanisms to extract surpluses, create social obligations and reinforce political alliances (Clark and Blake 1994; Hayden 2001).

A fifth strategy used by aspiring elite individuals is the materialization of ideology in the form of monument construction to legitimize elite economic and political power. Agricultural surpluses can support the labor force needed for monument construction (DeMarrais *et al.* 1996; Earle 1997; Knight and Steponaitis 1998; Spielmann 2002).

A sixth elite strategy is the investment of agricultural surpluses in enlarging their own families (as by acquiring wives) to provide a larger labor force (Hayden 1995, 2001). More wives and offspring improve the possibility of intensified resource procurement as a result of increasing labor inputs, so larger families have more opportunities to generate surpluses to invest in

prestige competition (Clark and Blake 1994). Multiple wives also provide an aggrandizer with a larger group of potential exchange partners.

The differential use of these strategies is related to the considerable amount of variability in status differentiation, political centralization and regional settlement patterns observed in chiefly societies around the world. Such features as the nucleation of population and demographic centralization could be explained by the presence/absence of warfare and/or specialized craft production. Societies in which warfare and/or attached specialized production were present would exhibit pronounced patterns of social differentiation as a consequence of personal status rivalry. The absence of defensive structures, the dispersion of rural households, and the presence of large centers with monumental construction could suggest the emergence of an elite focused on an ideological strategy in which collective ritual activity was important. The dispersion of population in several environmental settings, the differentiation of craft activities between sites, and pronounced distinctions between and within communities in the quantities of local and foreign prestige and symbolic goods could indicate the emergence and consolidation of social hierarchies based on wealth accumulation. Leaders in regions with low demographic levels and limited surplus production might chose a strategy based on ceremonialism and feasting as a way of centralizing resources and mobilizing labor based on the acquisition of social prestige (Dietler 2001). The study of these strategies used by aspiring rulers provides an excellent opportunity to understand better the organizational variety of early chiefdoms (Drennan 1996; Drennan and Peterson 2012; Drennan *et al.* 2010).

1.2 THE ETHNOHISTORICAL AND ARCHAEOLOGICAL MODELS FOR THE LLANOS.

Although relatively abundant ethnohistoric information on the Llanos of Casanare was gathered during the first contacts between the European invaders and the local populations settled in the region in the century XVI, there is scarce information about the prehispanic occupations (Aguado 1950; Carvajal 1956; Castellanos 1962; Gumilla 1963; Federmann 1958; Morey 1975; Rivero 1956; Simón 1963). At their arrival, the Europeans documented the presence of powerful Achagua chiefs who had the capacity to mobilize large combat forces (Castellanos 1962; Gumilla 1963; Morey 1975; Redmond and Spencer 2007). Their authority and political power were extended beyond the limits of their local communities and even some chroniclers indicate the presence of paramount chiefs (Morey 1975).

The Achagua lived in fortified settlements and made war in order to capture slaves, women and children (Gumilla 1963; Morey 1975). The chronicles confirm that the Achagua built small agricultural mounds and raised fields (Carvajal 1956; Gumilla 1963). Agricultural production was a central activity for the Achagua who were recognized as better farmers than other Casanare groups and controlled much of the productive land of the Llanos of Casanare (Morey 1976). The organization of agricultural production was based on household labor (Morey 1975). Cultivated species included manioc, maize, fruit trees, tobacco, onoto, yopo, and cotton, among others (Morey 1975). The Achagua produced shell beads or quiripas that were exchanged with other Orinoco groups (Morey 1975). These highly valuable goods were produced by specialists who were directed by craft officials (Rivero 1956). These items were used by the Achagua chiefs as finery in public displays but also as presents to other chiefs and some followers to establish

alliances and gain support (Gassón 2000; Morey 1975). It seems that the Achagua obtained unprocessed shells from other Casanare ethnic groups such as the Guahibo, exchanging agricultural products such as manioc, maize and yopo (Gassón 2000). The Achagua chiefs participated in and organized ceremonies called mirrayes in which the consumption of large quantities of food and beverages and the display of symbols of status were central. During these events, the leaders of the local communities made exchanges, established alliances with each other, and reinforced their status through the redistribution of food (Gassón 1998, 2009; Morey 1975; Rivero 1956).

Surplus mobilized from intensive agriculture could be used to finance the exchange of sumptuary goods and agricultural products. Whitehead (1994) has argued that exchange and warfare were two distinct facets of the same political strategy used by Orinoco's rulers. Besides that, Drennan has pointed out that warfare and the economic benefits of specialized production and intensive exchange are forces that can support stronger forms of social integration (Drennan 1995:329). The ethnohistoric information suggests that the Achagua from Casanare exchanged agricultural products such as cotton and yopo and some exotic goods as jaguar skins and macaw feathers with the Muisca from Boyacá (Langebaek 1996). From the Muisca, the Achagua obtained salt, pottery, polished stone artifacts, some gold, and blankets (Morey 1975). Although long-distance exchange of sumptuary goods was present in Barinas in small quantities (Gassón 1998; Spencer 1993, 1994), in contrast, it is likely that in Casanare the relatively close proximity of the powerful Muisca chiefdoms could offer better opportunities to the Achagua chiefs to establish productive and self-interested extra-regional relationships.

Chroniclers coincide in the presence of leaders among the different ethnic groups living in the Colombian and Venezuelan Llanos when Europeans arrived, although there is no agreement in the extension of their political power, it is an essential problem that must be challenged in the ethnohistorical descriptions of the South American lowlands (see Porro 1994).

On one hand, there are reports about leaders in the Llanos who exercised their command at the local level and did not enjoy inherited positions; probably they just were influential individuals in their own communities but not regionally. For instance, among the Guayupes, headmen seem to have controlled only individual villages (Kirchhoff 145: 387). Morey has pointed out that these leaders had "[…] little authority and no command rights. They lead primarily through example and persuasion" (Morey 1975: 103). In some cases, leaders could be abandoned by members of their groups (Poeck 1974: 174, 175). Ethnohistorical descriptions indicate that leaders retain their positions through their own actions and that their influence was limited to their local groups (Morey 1975: 104). In war times, the local leaders of several communities can choose a war chief among them to lead armies and when the conflict ended he returned to play his role as local headman (Gilij 1965: 170). Sometimes leaders were recognized by their ability for cultivation and also by their generosity at sharing food in private and public contexts (Morey 1975: 105). Gumilla (1963) suggested that the combination of these strategies allows to a man be considered as powerful. In addition, a man of prestige could increase their nuclear family taking more wives which represented more labor force to be invested in the agricultural fields and as a result produce more surpluses (Morey 1975: 101). Furthermore, "captains" in each village coordinated and assigned offices to the rest of people, they also

distribute the agricultural, fishing and hunt products in their respective communities (Morey 1975: 120), what suppose a degree of economic centralization and redistribution.

On the other hand, some accounts describe powerful chiefs who dominated several communities in broad regions of the Llanos (Gilij 1965; Gumilla 1963; Morey 1975; Rivero 1956). There are several indicators in the chronicles suggesting that the societies from the Llanos at the arrival of the Europeans were increasing their sociopolitical organization and economic stratification (Morey 1975: 306). Among groups such as the Caquetio, the Saliva, the Betoy, the Otomaco and the Achagua, paramount chiefs controlled several communities and their local leaders were subjected to them. These powerful chiefs took economic and political decisions beyond the village level (Cassani 1967; Rivero 1956). Kinship was very important to the assignment of principal political positions, there were families of prestige among which some individuals were selected to hold the position of chief (Morey 1975: 104). Reports suggest that chiefs displayed wealth distinctions and also there was craft specialization among them (Morey 1975: 307). The paramount chiefs could call for war to his secondary chiefs who must bring their support to them (Morey 1975: 112). In groups, much more attached to commerce and war, there was a corresponding increase in the power of the leaders and more importance attached publicly to this position (Gilij 1965, Morey 1975: 103). These leaders displayed especial paraphernalia and were buried in special tombs at dead (Morey 1975: 308).

Based on the European sources it is also possible to establish that there was certain degree of variability in the kind of strategies that leaders used to establish their rule. For instance, there were religious specialists, warfare leaders, craft specialists and merchants (Morey 1975).

Whitehead has proposed two “modes of leadership” in the Orinoco Basin, the “trading-military” and the “theocratic-genealogical” (Whitehead 1994: 39), and that the political action was directed toward the construction of local personal factions which growing according to the success in competing for external human resources (Whitehead 1994: 39).

Like chronicles can be biased by the ideology and misconceptions of the European reporters, their use in archaeology can lead to error. However, the argument here is not if the chronicles are correct or if their chronicles are just the product of the imagination of the chroniclers. The derived argument resulting from the analysis of ethnohistorical sources about the Llanos is that in the past the extension of the centralized power and the strategies used for emerging elite might varied according to the capabilities and possibilities that the aspiring rulers could dispose through time and space. The Llanos of Casanare would provide an alternative to evaluate the ethnohistorical models archaeologically.

In the Llanos of the Orinoco Basin, the archaeological evidence indicates that agricultural intensification was largely a project of elites (Whitehead 1994). For the Llanos of Barinas, Venezuela, two principal arguments have been advanced to account for prehispanic agricultural intensification in the form of large areas of raised fields. It has been argued that this was a response to population pressure in a region of limited productive potential (Zucchi and Denevan 1979) or, alternatively, that it was a strategy for buffering environmental risk to agricultural production (Gassón 1998; Spencer 1998). The argument for population pressure is weak because although there was an increase in population between 1 and 500 A.D., when raised field systems were built, there were still large areas suitable for cultivation in the Llanos of Barinas that

remained empty. In addition, archaeological surveys in the regions of El Gaván and El Cedral indicate that, although between 1 and 1000 A.D. the regional population grew, it remained well below the level that would generate resource pressure (Gassón 1998; Spencer *et al.* 1994). In contrast, pronounced unpredictability of water availability related with short-term (one year), middle-term (between 3 and 5 years) and long-term (more than 10 years) cycles of climatic fluctuations of both prolonged droughts and destructive floods, created risks to agricultural production based on swidden, small garden or levee cultivation in the Llanos (Gassón 1998). Agricultural intensification based on the construction of raised field systems could help buffer environmental risk (Gassón 1998; Spencer 1993, 1994). The agricultural resources generated on raised fields could be used during bad years in which alternative agricultural practices failed to provide local populations. During good years in which swidden, small garden and levee cultivation were successful, the raised field production generated surpluses that could be directed toward elite political activities such as warfare, feasting, long-distance exchange and creation of monumental architecture, all activities that could enhance the elites' own status, wealth, power, and/or authority (Gassón 1998; Spencer 1993, 1994).

The Llanos of Casanare has been one of the regions least studied by archaeologists in Colombia (Figure 1.1). This region is similar to the Llanos of Barinas from an environmental and geographical perspective. The climatic fluctuations marked by strong droughts and intense floods define a regime of spatial and temporal variability and instability in resource availability (Torres and Botero 1999:60). The Llanos of Casanare are distributed on landscape units of high, medium and low savannas near the Andean piedmont similar to the Llanos of Barinas. These features suggest that during prehispanic times, it is likely that in the Llanos of Casanare there were levels

of environmental risk similar to those encountered in Barinas. In general, the scarce archaeological research in the region has pointed out the presence of nucleated and dispersed sites with surfaces which sometimes exhibit high concentrations of ceramic materials. These sites often are located in association with agricultural raised fields.

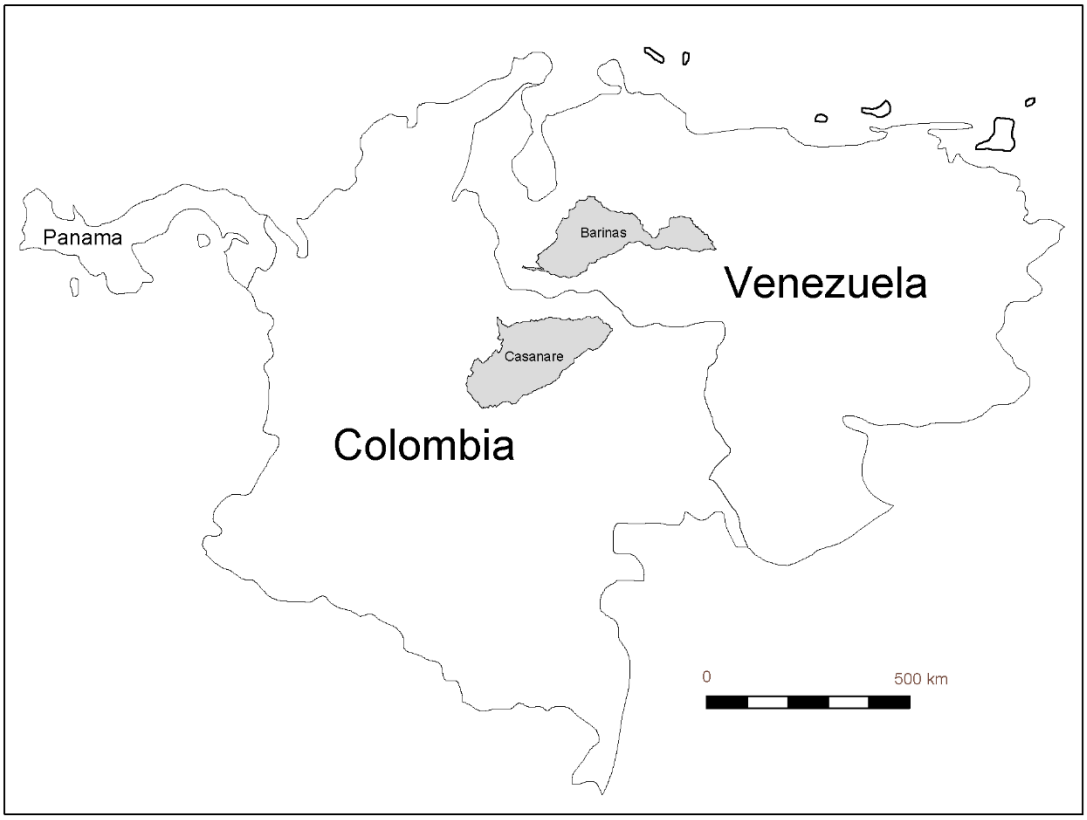

Figure 1.1 Llanos of Casanare (Colombia) and Llanos of Barinas (Venezuela).

Both the scarce archaeological evidence and the ethnohistoric information indicates that the societies from the Llanos of Casanare were generally similar to those of the Llanos of Barinas. It seems that Casanare, like Barinas, was in prehispanic times, a region of low population

distributed in widely scattered clusters, with environmental fluctuations providing opportunities and risks which were coped with in part by constructing agricultural raised field systems.

Despite these similarities there are some differences in the archaeological record that suggest that agricultural surpluses might have been used differently by the emerging elites of Casanare. For instance, in Barinas nucleated settlements were located far away from each other (more than 5 km). The Casanare settlements, although highly nucleated, are closer together (within 1-3 km). The territories of the Casanare polities may have been smaller than those of Barinas, perhaps indicating that the power of emerging leaders of these communities was more limited in comparison with that of Barinas rulers. Buffer zones between clusters of settlement also seem small in comparison to those from Barinas, which may suggest that the intensity of warfare was lower than in Barinas and that the agricultural surpluses were directed mainly to support alternative elite strategies such as long-distance exchange, craft production and ceremonialism. However, smaller buffer zones and the nucleation of population might also indicate that these communities were more centralized than in Barinas, and this might suggest more intense warfare with other polities than in Barinas. Monuments and site size have been the basic criteria for defining regional hierarchies of settlements in Barinas. Yet, it seems that in Casanare the construction of monuments was not a strategy used by the emerging chiefs. If in Casanare people did not construct monumental residential or ceremonial architecture is likely that chiefs used other ideological strategies to legitimize their power such as the production of symbolic objects (e.g. quiripas) or public ceremonies. If production and distribution of symbolic and prestige objects, and feasting played a central role in Casanare and required the investment of large quantities of agricultural surpluses it is likely that warfare was a factor of less relevance.

Although there is evidence from differential proportions of ceramic consumption and vessel functions that suggests the celebration of feasts at El Cedral (Gassón 1998), there is no archaeological information to support this elite strategy in Casanare so far.

In addition, the proximity of the powerful Muisca chiefs in the neighboring Altiplano Cundiboyacense could have defined a different context for political and economic interaction, in comparison with the context in which Barinas's rulers acted. The opportunities available to the emergent Casanare chiefs, then, were not identical to those presented by Barinas, and this might have affected both the internal and external strategies (Spencer 1993) in which they invested agricultural surpluses to consolidate their positions, build their political factions, and achieve their political aims. It is likely that these differences in circumstances provided different material and social resources to the aspiring elite of Casanare, producing a trajectory of sociopolitical change that differed from that of Barinas. These differences could have led to variation in the timing, pacing, demographic scale, spatial scale, degree of centralization, elaboration of social hierarchy, and other characteristics of these emerging complex societies.

In sum, the environmental context, the ethnohistoric descriptions and the archaeological evidence suggest that in the Llanos of Casanare the intensification of agriculture could generate surpluses that played an important role in the institutionalization of social inequality and the emergence of complex social organization as in the Llanos of Barinas. If the aspiring elite of the Casanare communities controlled agricultural surpluses they could invest them to promote their own interests. However, it is not clear if the Casanare chiefs privileged warfare and feasting as the principal strategies in which to invest agricultural surpluses as seems to have occurred in

Barinas or if they placed more emphasis on other means of competition such as exchange and craft specialization. The environmental characteristics of both regions indicate that they had to confront similar risks produced by the short-term and long-term cycles of climatic fluctuations.

1.3 RESEARCH QUESTIONS AND GOALS OF THE RESEARCH

This research focuses on the investigation of the different choices that the leaders of prehispanic Casanare communities had at their disposal and the impact of their decisions on the development of social complexity in the region.

The information reported here has provided the basis for addressing questions related to the conditions and strategies determining the emergence of leadership in Casanare. In order to compare the trajectories of change that led to the chiefly societies of the Llanos of Casanare and Barinas, the proposed research sets out to address the following questions:

1.3.1 Research Question 1.

Were the chiefly polities that appear to have existed in Casanare, similar to those of Barinas in spatial and demographic scale? In degree of centralization?

Answering the first research question has required comparing the chiefly polities known for Barinas to the similar social formations documented for the Catanga region in Casanare. The Barinas regional polities were delineated on the basis of regional-scale settlement study like that proposed for Catanga. Specifically, the patterns interpreted by Spencer and Redmond (1992), Spencer (1993; 1994) and Gassón (1997, 1998) as regional polities were the emergence of two

villages much larger than any previous settlement, one at El Gaván and one at El Cedral (estimated to have some 1000 and 3000 inhabitants, respectively). Each of these villages lay at the center of a cluster of settlements; the clusters were separated from each other and from other zones of settlement by sparsely populated buffer zones. The cluster around El Gaván was about 8 km across, and its total population is estimated at 3000; the cluster around El Cedral was about 17 km across, and its total population is estimated at 6000. The regional survey research in the Catanga region has documented the presence of settlement clusters estimating their spatial and demographic dimensions, based on precisely the same kind of evidence that led to the reconstruction of such patterns in Barinas. In addition, the degree of demographic centralization is measured for clusters at El Gaván, El Cedral, and any indicated in Catanga (see Drennan and Peterson 2008) to assess and compare the strength of the centripetal forces that drew population toward the central places in each. Altogether this information provides the basis for saying whether any centralized sociopolitical organization documented for Catanga exceeded the scale or intensity of Barinas regional polities.

1.3.2 Research Question 2.

Did Casanare polities emerge sooner or was this a process that took more time than in Barinas?

The exact absolute dates when regional chiefly polities emerged in Barinas are unknown, but this sociopolitical transformation took place during Late Gaván (550–1000 A.D.) times, and presumably near the beginning of this period. The essential information for answering the second question, concerning the relative timing of such a change in Barinas and Casanare, is identifying

the period in which regional polities, of whatever scale (see previous paragraph), emerged in the Catanga region. If this transformation is apparent for the first time in the regional settlement patterns around 550-1000 A.D., then it was roughly contemporaneous with the emergence of regional polities in Barinas. The implications of such a chronological placement are that interaction with other chiefly polities in the Llanos, whether conflict or more peaceful exchange, might have been important in the strategies of emerging Casanare chiefs, since this is the period when those other polities appear to have existed. If regionally centralized organization first appears closely to 1000-1550 A.D., it post-dated Barinas polities; relationships with highly developed Muisca chiefdoms might have been more important, since this is the period when those polities were most highly developed. If regional centralization began in Catanga in before 550 A.D., its emergence is more likely related to internal dynamics because neighboring regions at this time had only very small populations and little indication of regionally centralized organization.

1.3.3 Research Question 3.

Is there any evidence of exchange between the Casanare polities and the Muisca area or other Orinoco Basin regions? If so, what was its intensity? What were the kinds of goods exchanged?

Evidence of trade between Barinas and other regions comes from ornamental artifacts such as beads and pendants recovered in surface collections in the regions around El Cedral and El Gaván. These were made of serpentine, jasper, red jasper, slate, and malachite, among other materials, which came from the high Venezuelan Andes, the Caribbean mountains near Caracas, the Sierra Nevada de Santa Marta and even the high Colombian Andes (Gassón 2000; Redmond *et al.* 1999;

Spencer 1994, 1998; Spencer and Redmond 1992). In surface collections at sites such as El Cedral, these artifacts were spatially associated with shell beads and fine local pottery in areas of elite activity (Gassón 2000). The shell beads from El Cedral were made of *Pomacea* sp., a common mollusk in the Llanos so they are not taken as evidence of trade with other regions but their spatial association with other fine local artifacts suggests that they were used by elites at El Cedral. The abundance of such artifacts in elite contexts, compared to the materials from Barinas, will indicate whether such exchange was more or less intensive in Catanga. Similarly, if Muisca ceramics are spatially associated with elite materials in Catanga, elite connections with the Muisca area will be indicated. None were recovered at El Gaván or El Cedral regional, but they have been reported from Casanare (Giraldo 1988; González and Riaño 2000). If the Catanga survey bears this out and documents elite associations, then a relationship to more powerful chiefs in neighboring regions may set Casanare chiefs apart from those of Barinas.

1.3.4 Research Question 4.

Is there any evidence such as buffer zones, enclosures, or palisades that suggest that warfare was present in Casanare and that it was an important strategy used by the Casanare chiefs as has been argued for Barinas?

Warfare involves multiple communities and/or polities in a region, and regional survey has provided much of the information upon which discussions of warfare in Barinas have been based. The Catanga survey has provided precisely comparable information for answering the fourth question. In both the El Gaván and El Cedral regions, archaeological sites were clearly delineated, presented high densities of archaeological materials, and were separated by space without

evidence of occupation. Such compact, nucleated settlement is sometimes associated with a need for defense. Around the large central settlements of El Gaván and El Cedral, were massive oval embankments with evidence of palisade construction. The raised causeways that connected them to other smaller villages would have facilitated the mobilization of fighting forces (Spencer and Redmond 1998). The presence and nature of such features in Catanga will be documented just as it was in Barinas for comparison. The clusters of villages associated with El Gaván and El Cedral, respectively, were separated by a wide buffer zone devoid of settlement, suggesting that these two polities competed and fought with each other, at least at the Late Gaván times (Redmond *et al*. 1999). The nature of separation between any settlement clusters observed in Catanga will also be documented just as it was in Barinas, facilitating comparison. Wider, emptier buffer zones and more massive or numerous earthen defensive structures would suggest greater intensity or higher stakes in warfare, and thus the possibility of greater reliance on warfare as a strategy for political consolidation on the part of chiefs.

1.3.5 Research Question 5.

Is there any evidence about feasting in Casanare, similar to Barinas, that suggests that it was an important political and economic strategy used by the Casanare chiefs?

The evidence used to argue for the importance of feasting as an elite strategy at El Cedral comes from the proportions of small serving vessels in surface collections (Gassón 1998). Of the 100% of the ceramic materials of the surface collections in El Cedral 25.77% were small serving vessels, while of the 100% of the materials recovered in all the secondary centers together the proportion of small serving vessels was 7.22%, and in the third order sites together this proportion was

8.73%. This observation was the basis for Gassón's (1998) conclusion that feasting was an important elite strategy at El Cedral center during Late Gaván times. The Catanga survey provides exactly the same kind of information, making it possible to compare the intensity of feasting, its degree of concentration in central places, and its spatial association with elite activities.

2.0 THE REGIONAL SURVEY AND CHRONOLOGY

2.1. THE REGIONAL ENVIRONMENTAL SETTING

The characterization of the different climatic, ecologic and geologic dynamics that affect the region must be considered one of the most important concerns for the archaeological research in the Llanos of the Orinoco. Climate, environment, and soils determine the distribution of resources and their availability but also define those areas in which humans can settle. Although the Llanos are perceived as an ecologically homogeneous region, this is a wrong perception that ignores environmental variability. The Llanos are highly diverse and variable in terms of the distribution of natural resources. Environmental variability determines the differential spatial distribution of resources through the ecological zones, that are present in this macro-region. In addition, there is also temporal variability in the resources caused by the climatic regime with intense seasonal fluctuations which determines scarcity/abundance of resources in short term (year to year), middle term (every 5 to 7 years) and long-term (more than 15 years) cycles (Gassón 1998; Redmond and Spencer 2007; Vargas 2011). In the Llanos, there are successive periods of intense floods and prolonged droughts.

The environmental conditions in the Llanos are related to the kind of challenges and possibilities that the human populations must confront to ensure their own subsistence and their social reproduction. In archaeological terms, it is important to understand how this

environmental context affected human interaction, how it was modified, and how it was related to the economic, social, political and ideological changes experienced by populations throughout their evolutionary trajectories.

Although there are discussions about whether current environmental conditions in the Llanos were produced by human activity during the last 6000 years, Torres and Botero (1999) consider that these are the result of natural edaphic and climatic processes. The Paleo-climate of the Orinoco Basin has been characterized by the alternation of moist and dry cycles through the late Pleistocene and the early Holocene which suggest an intense dry period during the Late Pleniglacial (26000 - 14000 B.P.) and a prolonged moist period during the Late Glacial (14000-10000 B.P.) (Van der Hammen 1992).

Torres and Botero (1999) have stated that in the Llanos during the last 12000 years, changes in climate and vegetation have been produced by the continuous advance of humid forests and the savanna grasses over cyperaceous vegetation. These environmental features suggest an increase in humidity and temperature since 6000 B.P. The moist conditions have remained relatively constant as a result of the human intervention. The presence of termites and anthills has stimulated the growth of forests in this macroregion. The advance of the forest vegetation coincides with the decrease of the total area of the high alluvial plains, as a consequence of the erosive processes, these geo-physiographic units have to lose their peaks characterized by the presence of the most developed soils in the region (*Oxisols* and *Ultisols*). These processes are observable in the Llanos of Casanare and Barinas. The alluvial and eolian sedimentation produced by the orographic processes of the Andes and the transporting,

weathering and washing cycles of the Cretaceous and Tertiary materials, produced soils in the Llanos with a mineralogical composition dominated by kaolinites, quartz and hydroxides of iron (Torres and Botero 1999). Soils in Casanare and Barinas are parental in origin and are composed of alluvial deposits covered by a thin eolian layer. They present acid reaction with low to a very low content of organic matter. The principal types of soils in the study area are UDULTS, DYSTROPEPTS, PSAMMENTS, AQUEPTS, AQUENTS, AQUULTS and some EUTROPETS (IGAC 1986).

The historical records show that the macro-regional climate is ecologically homogeneous. In general, the annual temperature oscillates between 26 - 28 Celsius degrees. The annual precipitation fluctuates between 1300 mm and 2200 mm. There is a rainy season during a period of 7 - 8 months. January, February, March, April, and November are considered as dry months.

In terms of agricultural productivity soils are similar in Barinas and Casanare; however, it seems that drainage conditions are better in El Gaván region because of its proximity to the piedmont. In this region, the larger proportion of settlements were located over an alluvial fan with good productivity and drainage conditions. El Cedral and the larger sites in this region were located in bancos with relatively good soils for farming very similar to the bancos in which people were settled in Casanare during prehispanic times (Vargas 2011).

Sarmiento *et al.* (1971) have proposed four typical relief systems that characterize the Llanos of Barinas and that are present in Casanare: alluvial terraces, savannas, bancos, and bajios. Each relief is associated with different types of vegetation, soils, water sources and fauna. They integrate four environmental zones: forest, dry savannas, flooded savannas and esteros (Sarmiento *et al*. 1971).

The alluvial plain includes the overflow banks (bancos) and the primary and secondary terraces covered by forests in which it is possible to identify a large variety of palms such as *Oenocarpus bataua, Socratea exorrhiza, Attalea maripa, Attalea insignis, Oenocarpus minor*. The gallery forests are composed of different species of trees and function like fauna reservoirs (Rodriguez and Duque 1999). The agricultural potential of the forests units is high because of the edaphic and hydric conditions (Figure 2.1).

Savanna units are composed mainly by dominant species such as herbaceous, grasses, cyperaceae, xyridaceae and juncaceae such as *Axonopus purpusuii, Axonopus fissifolious, Digitaria decumbens, Eragostris Maypurensis, Panicum* spp*., and Mesosetum* spp. In the past four decades, some new grass species such as *Melinis minutiflora, Brachiaria decumbens, Panicum laxum, Panicum purpurances, Panicum maximum* have been introduced by the locals (Rodríguez and Duque 1999) (Figure 2.2). The agricultural potential of the dry, flooded and humid savannas is very low. There are three different types of dry savannas: *Trachypogon vestitus - Axonopus purpusii savanna,Paspalum pectinatum savanna and Trachypogon vestitus savanna* (Rodríguez and Duque 1999). The soils in this ecological zone are very poor in terms of the agricultural productivity and for that reason, they are dedicated currently to cattle raising.

Figure 2.1 Gallery Forest. Caño Seco.

Figure 2.2 Dry Savanna.

There are two types of flooded savannas. The first one is the *Andropogon* savanna which is structured by two strata of vegetation, small and medium woody shrubs. This savanna type has a physiographic position in the flood plain and it is over soils of fine structure. The second type is the *Mososetum* savanna characterized by an open low-level vegetation such as (*Caraipa llanorum*) and palmares de moriche (*Mauritia flexuosa*). The dominant species in this savanna type are *Mesosetum chasae*, *M rottoellioides* y *Panicum stenodes* (Rodríguez and Duque 1999) (Figure 2.3).

Figure 2.3 Flooded Savanna.

There are also two types of humid savannas. The *Leptocoryphium lanatum* savannas are characterized by the absence of trees and located on the lower terraces of the dissected and Eolic floodplain. The predominant species in those units are *Lectocoryphium lanatum, Andropogon*

selloanus, Axonopus purpusii y Sorgastrum parviflorum (Rodríguez and Duque 1999). On the other hand, the *Trachypogon plumosus* savanna is composed by scrubs. Although these units are deficient for farming they are currently used for rice cultivation (Sarmiento *et al.* 1991) (Figure 2.4).

Figure 2.4 Humid Savanna.

The esteros are flooded areas caused by the accumulation of permanent or seasonal waters, where abundant macrophytic aquatic plants (Rodríguez and Duque 1999). In general, these areas are not suitable to human settlement (Figure 2.5).

From a physiographic perspective, in the study area, landscapes correspond to elevated alluvial terraces with good drainage and low alluvial terraces with slow drainage over medium, fine and very fine sediments. These terraces form wide strips of 7 to 80 km wide which are located

parallel to the piedmont as part of large ancient alluvial fans. These landscape features also are present in Barinas.

Figure 2.5 Estero.

In sum, the environment in the Llanos of Casanare and Barinas is highly variable in terms of climate, landscape units, relief forms, vegetation, soils composition, and drainage. These features have imposed some conditions on human groups through time. Although archaeological data is scarce, the available information suggests that the archaeological sites and the agricultural raised field systems in Casanare were located in elevated alluvial terraces and bancos covered by gallery forests, with good soil drainage conditions (AAEUA 1993; Alarcón and Segura 1998; Giraldo de Puech 1988; López and Mora 1990; Mora 1989; Mora and Cavelier 1985, 1989; Mora and Márquez 1982).

2.2. SURVEYING THE STUDY REGION

Archaeological survey was carried out in a region totaling 220 km^2 (Figure 2.6). Bancos and high alluvial floodplains covering a total of 10 km^2 were subjected to complete full-coverage survey, as were 5 km^2 where ancient raised agricultural fields were observed. Survey teams walked back and forth across these areas at 100-m spacing. In the bancos and high alluvial terraces usually grass and other vegetation obscured the visibility, so surface collections could not be made. In these conditions, small shovel probes were excavated at 100-m intervals. Shovel probes were 40 by 40 cm and were excavated to 80 cm deep. A soil auger was used at the bottom of every tenth shovel probe to reach a depth of 2 m and investigate whether there were more deeply buried deposits. The soil auger never revealed indications of deposits below the 80-cm depth to which shovel probes reached.

The lack of visible surface artifacts made it necessary to excavate additional shovel probes in the areas around ones that yielded artifacts in order to delineate the areal extents of artifact scatters. At every positive shovel probe a north-south line of additional probes at intervals of 15-25 m was excavated until there were five consecutive probes without artifacts. The north-south line was used as an axis to locate additional shovel probes in an east-west direction at intervals of 15-25 m. The information from the additional shovel probes in north-south and east-west directions, together with natural features of the landscape such as caños and matas de monte, as well as fence lines were used to determine the limits of artifact distributions. In artifact scatters larger than 1 ha, artifacts were collected separately in collection units of 1 ha or smaller, thus

subdividing the larger artifact scatters into smaller parcels. The locations of shovel probes, the limits of artifact distributions, the limits of individual collection units, and surface features such as mounds or raised fields were all drawn on the aerial photographs. Locations were verified with GPS readings.

Table 2.1 Archaeological sites with number of associated shovel probes.

Archaeological site	**Positive shovel probes**
Catanga	122
Catanga 2	17
Catanga 3	5
El Arenal	181
El Viento	10
El Medano	10
Corinto	120
El Pensil	159
Tucuragua	22
Las Brisas	7
La Esperanza	4
Tilodirán	58
Santa Juana	55
El Coco	24
Total	**794**

Altogether, 14 archaeological sites covering about 60 ha were recorded in the complete-coverage survey of the bancos and high alluvial floodplains (Table 2.1). The occupied area amounts to 6.0% of the total area of bancos and high alluvial floodplains. By comparison, in the case of El Cedral region (Gassón 1998) around 24 km^2 of the 60 km^2 that were surveyed correspond to high alluvial terraces and a total of 1.39 km^2 (5.8%) were occupied. In El Gaván 435

km^2 were surveyed, of which around 78 km^2 were located in areas of bancos, and the total occupied area was 1.26 km^2 (1.6% of the high alluvial floodplains area).

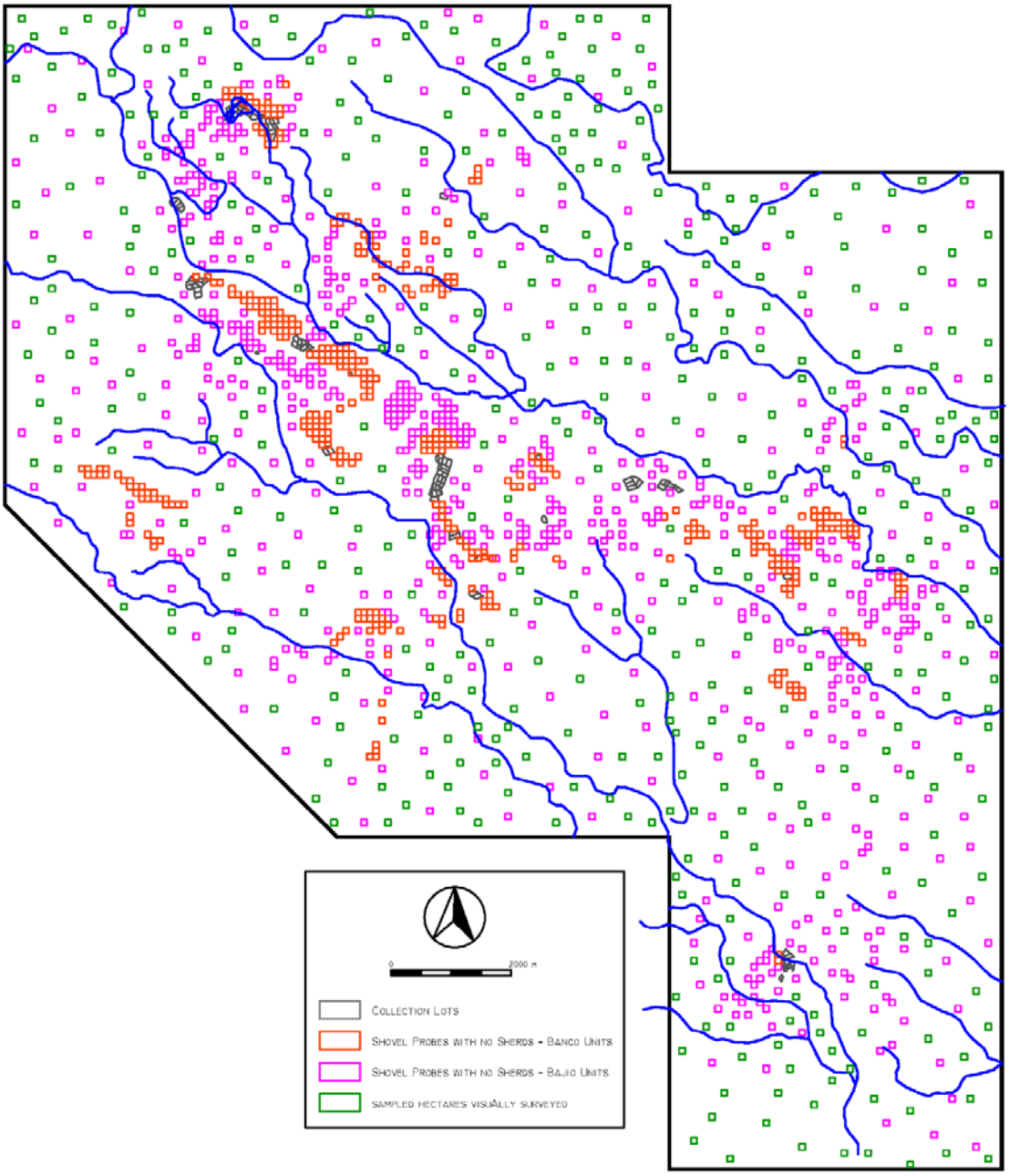

Figure 2.6 Study Area. Distribution of Collection lots.

In addition to the 15 km^2 of complete-coverage survey, 205 km^2 of poorly drained bajío and humid savanna (where little or no occupation was expected) were sampled. A total of 1025 1-ha quadrats were randomly selected with a systematic design to spread them broadly across this territory. In a grid of 1 km squares, five 1-ha quadrats were randomly selected from each square. In addition, 118 extra 1-ha quadrats were judgmentally selected for survey because on the go survey teams considered that their characteristics such as soil color, soil texture, vegetation distribution, or type of grasses might indicate higher probabilities of human occupation. Altogether, then, 1143 randomly and judgmentally selected 1-ha quadrats were surveyed in the poorly drained bajío and humid savanna.

In general, in these 1143 units surface visibility was good because vegetation was sparse as a result of the intensely dry conditions that occurred during the fieldwork. In 419 of these quadrats, surface visibility was adequate, and the survey teams walked over them to identify artifact scatters. In 214 of the other 724 quadrats, surface visibility was poor, and four shovel probes were excavated, one in the center of each quarter of the quadrat (following Drennan 2006: 25). In the remaining 510 quadrats, surface visibility was intermediate and permitted evaluating the presence of artifacts through surface inspection to some degree. In these 510 quadrats, the surface inspection was supplemented by excavating one shovel probe in the center of the quadrat to make sure that there were not cultural deposits that had been buried by the cyclical flooding of the savannahs. Following this strategy, a total of 1366 shovel probes were excavated in the bajíos and humid savannas.

The random sample of 1025 1-ha quadrats revealed no evidence at all of human occupation in the bajíos and humid savannas. This strongly suggests that occupation in this zone was trivial, but it does not rule out the possibility of occupation that the sample missed. Based on the sample, though, we can be 63% confident that fewer than 0.1% of the 1-ha quadrats in the bajío and humid savanna sampling universe show evidence of human occupation (Drennan 2010: 251-254). If this proportion of the 1-ha quadrats in the sampling universe were in fact occupied in prehispanic times, it would amount to a total of about 20 ha of occupation. This would increase the occupied area documented on the bancos and high alluvial floodplains by only about one-third. It is thus statistically possible that the population estimates provided below have underestimated the real prehispanic population of the region for this reason, but only very slightly.

The 118 judgmentally selected 1-ha quadrats also produced no evidence at all of human occupation. If these units are included as part of the random sample, bringing the total number of units to 1143, our statistical confidence increases to 70%. Since these judgmentally selected units produce a sampling bias in favor of finding occupation, adding judgment to statistics makes us even more confident that occupation of the bajíos and humid savannas was very scanty at most. In sum, it is most likely that the real population of the bajíos and humid savannas was truly negligible. In the worst case, even the statistically possible population in the bajíos and humid savannas would make only a very small difference in the regional estimates, and would be too small to have any impact on the demographic conclusions and comparisons.

Finally, several locations to conduct stratigraphic tests were identified during the regional survey of the bancos. These locations exhibited high densities of multiple ceramic types likely pertaining to different periods. These cultural deposits presented substantial depth, making it likely that the stratigraphic relationships between different sorts of ceramics could be determined. A total of 9 stratigraphic tests were conducted in the archaeological sites of Corinto, Tilodirán, El Arenal and Catanga. Just 4 tests, 2 in Catanga and 2 in El Arenal, exhibited the better conditions in terms of a number of remains, the variability of artifacts, preservation and defined stratigraphy to establish chronological relationships among ceramic materials, in special test CA-CT-CE-07 at Catanga which was the only one meet all these conditions together. The other tests conducted at locations on Tilodirán and Corinto do not meet these criteria because the areas were strongly altered by human activity. The next section presents the results of the analysis of the tests conducted at the archaeological sites of Catanga and El Arenal.

2.3. CERAMICS AND REGIONAL CHRONOLOGY

In the archaeological research of the Llanos of the Orinoco the use of ceramic analyses has been a constant. The first attempt to organize the ceramic material of the region was made by Cruxent and Rouse (1952) who proposed the first chronological scheme for the Llanos of Barinas for materials that were recovered in different places across the region in Venezuela. However, it was not until the 1960's that a complete chronological ceramic scheme was designed. Zucchi (1967) established the basic chronological scheme of the Osoide series for the Venezuelan Llanos,

dividing it into two phases: The Caño del Oso phase (which she dated at 230 B.C.–650 A.D.) and the La Betania phase (dated at 650–1200 A.D.). After Zucchi, Redmond and Spencer (2007) have suggested an alternative scheme, the Gaván complex, subdivided into an Early phase (which they date at 300–550 A.D.) and a Late phase (dated at 550–1000 A.D.). The number of radiocarbon dates available for establishing the beginning and ending dates for these ceramic complexes, however, is quite small. Since there are numerous stylistic similarities in ceramic attributes linking the two schemes, the Gaván complex must at present be considered roughly contemporaneous with Zucchi's Caño del Oso and La Betania phases (Redmond and Spencer 2007). Zucchi's prehispanic sequence for the middle and lower Llanos of Barinas ends with the Caño Caroni complex (which she dated at 1200–1400 A.D.). These materials must be treated as contemporaneous to the Caño Seco Complex defined by Redmond and Spencer (2007) for Barinas and dated by them to 1000–1550 A.D.

In the case of the Llanos of Colombia, Mora and Márquez (1982) have proposed three ceramic types for the Tilodirán region in Casanare: Catanga Burdo, Catanga Sencillo, and Catanga Fino. These types have appeared in association with one radiocarbon date at A.D. 1600 ± 50.

The existing ceramic classificatory schemes for the Llanos are problematic in terms of the survey methodology because they do not provide a means by which settlements in the study region could be dated. An important requirement of any typology is that it makes it possible to identify each individual sherd collected as to the period of manufacture (Drennan *et al.* 1993). However, the existing schemes are based on attributes such as form and decoration that only

could be observed in a small proportion of the total of sherds recovered during the archaeological survey of the Catanga region.

One of the purposes of this research was to refine the previous schemes in order to provide a useful classificatory system to reach the research goals. During the first phase of the analysis conducted in the laboratory, an intuitive approach was used (Sinopoli 1991).

The classificatory system proposed here emphasizes ceramic variables related to technology rather than general appearance. Attributes such as temper, paste color, and surface treatment were considered more useful than other attributes such as decoration, vessel form and rim form. In the proposed classificatory system, the attributes analyzed were hierarchized and temper was prioritized to separate ceramic artifacts in groups. Temper demonstrated a consistency in stratigraphic terms that allows assigning a chronological period to every sherd recovered during the regional survey. Although during the analysis of ceramic materials, the paste color was selected as the main criterion to organize groups of sherds, the statistical analysis did not reveal a useful pattern to achieve the chronological classificatory purposes. Statistical analysis also demonstrated that surface treatment was not useful to achieve the chronological goal. In this Chapter, I have included the 4 tests that were used to elaborate the chronological ceramic scheme. The results of these analyses are presented below.

2.3.1 Test CA-CT-CE-07

Test CA-CT-CE-07 of 1 m by 1 m was located in the northeastern part of the Catanga archaeological site. During the intensive survey in this area, the shovel probes produced large amounts of ceramic, lithic and faunal remains. Although the area's surface has been plowed repeatedly several times during the last thirty years it still is possible to observe the presence of at least one rounded feature that likely corresponds to one mound structure. This mound does not exceed 1 m in height and 30 m in diameter on average. The deposits near the mound structure were deeper than in other parts of the site, and the ceramics near the mound appear to show higher proportions of a decoration than those from elsewhere. Based on these findings the stratigraphic test CA-CT-CE-07 was conducted in the north of the mound CA-MD-CT-01.

Test number 07 was excavated using arbitrary levels of 5 cm deep reaching 1.30 m. Test profiles exhibited 5 clearly differentiated strata (Figure 2.7).

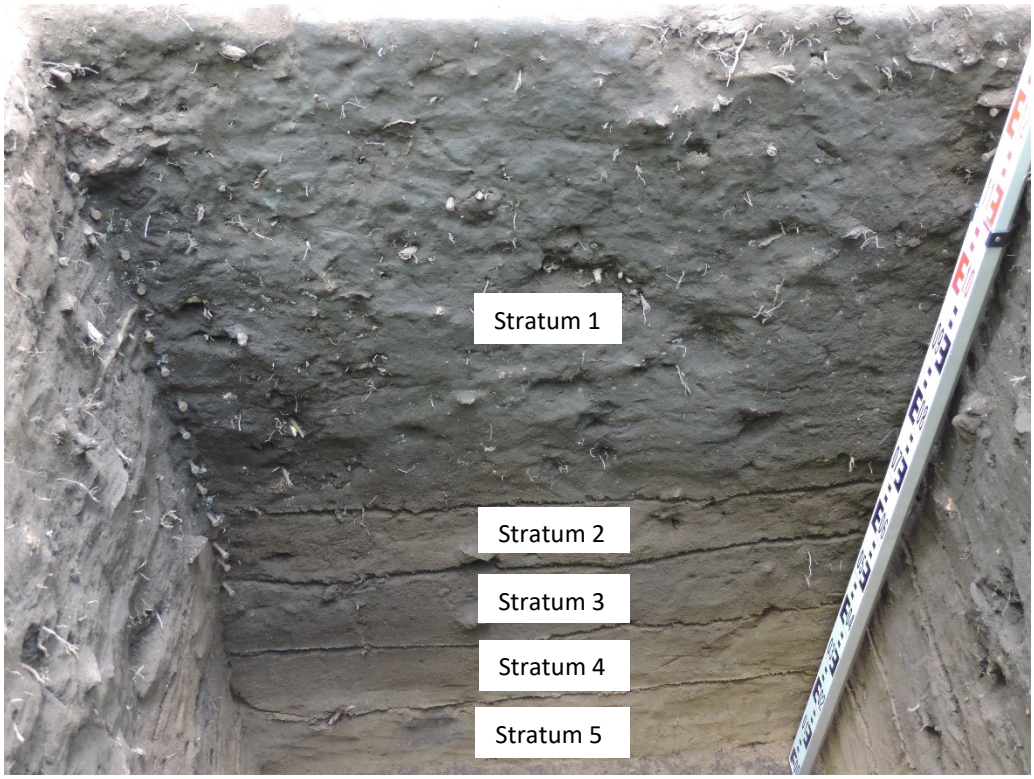

Figure 2.7 North Profile, test CA-CT-CE-07.

A total of 3842 sherds were recovered during the excavation. The concentrations of archaeological materials vary according to depth as presented in the next graph (Figure 2.8).

The triple peaked distribution of ceramic materials suggests different occupations of the mound area through time. The decrease/increase in sherd proportions by level has been interpreted as an indicator of at least three different occupations. The earliest occupation was located from levels 13 to 18, a middle occupation between levels 6 and 12 and a late occupation from level 0 to 5. To analyze the ceramic materials, it was considered this subdivision by levels. Then, the first subgroup includes the proportion of sherds deposited in levels 0 to 5, the second group includes sherds from levels 6 to 12 and the third group includes all sherds recorded in levels 13 to 18.

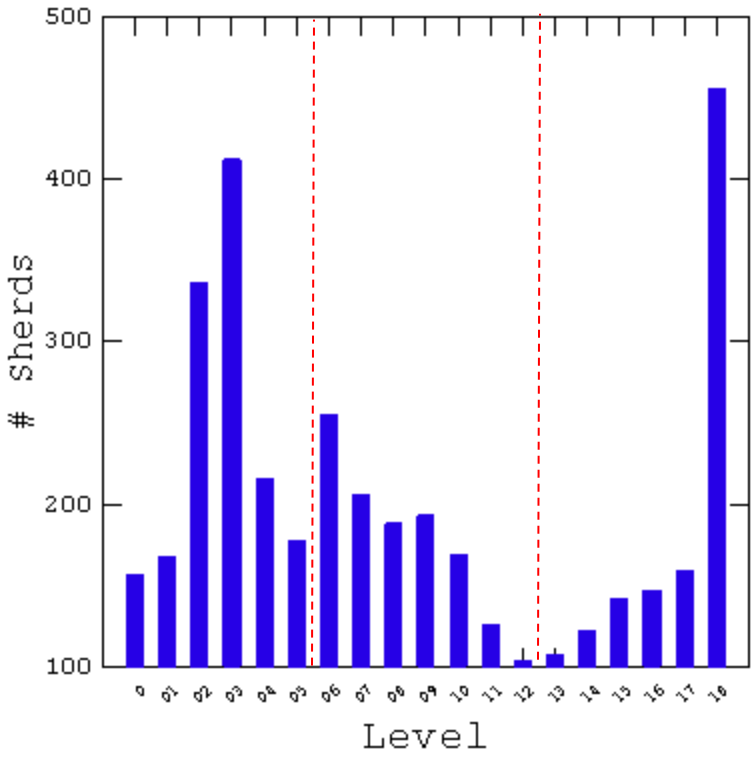

Figure 2.8 Concentrations of sherds by arbitrary level of excavation. Test CA-CT-CE07.

2.3.1.1 Temper Analysis test CA-CT-CE-07. 7 different materials were used to temper ceramics from the study region which include kaolin, vegetal fibers, oxides, laterites, sediments, crushed stones and crushed sherds. These materials appeared frequently mixed together; however, one of them appears as a much larger proportion than the others in a sherd. For instance, it is possible to observe a combination of kaolin and oxide tempers in the same artifact, though, in most cases, it is easy to establish if the proportion of kaolin exceeds oxides or vice versa.

The analyses of sherd temper proportions by levels indicate that organic fibers were the material most used in 13 to 18 levels (Figure 2.9). Although materials such as sediments, oxides, and Kaolin were used as temper they appear in low proportions.

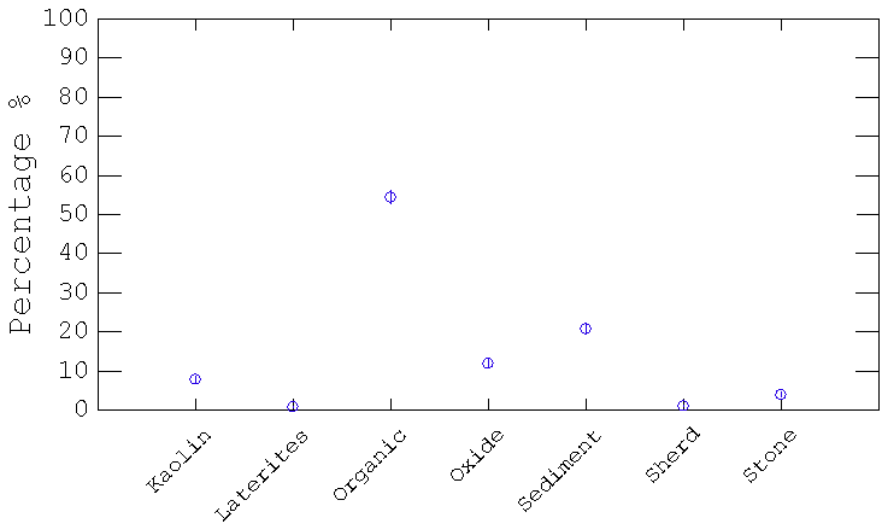

Figure 2.9 Sherd proportion by temper. Level 13 to 18. Test CA-CT-CE07.

Kaolin is the temper material most frequently used in levels 6 to 12 (Figure 2.10). Organic fiber decreased in those levels but this material is still used. Although materials such as oxides, organic fibers and sediments also were used as tempers they appeared in low proportions in those levels. It is important to consider that although there are temper materials that represent better a period because they were used more often than others, it does not mean that they were exclusive to that period.

Between level 0 and 5 it is not possible to establish a clear tendency that shows a preference for a specific temper material (Figure 2.11). However, it is clear that oxides and sediments in the superior levels have become more popular than in the lower levels, nevertheless the proportions of kaolin remain high.

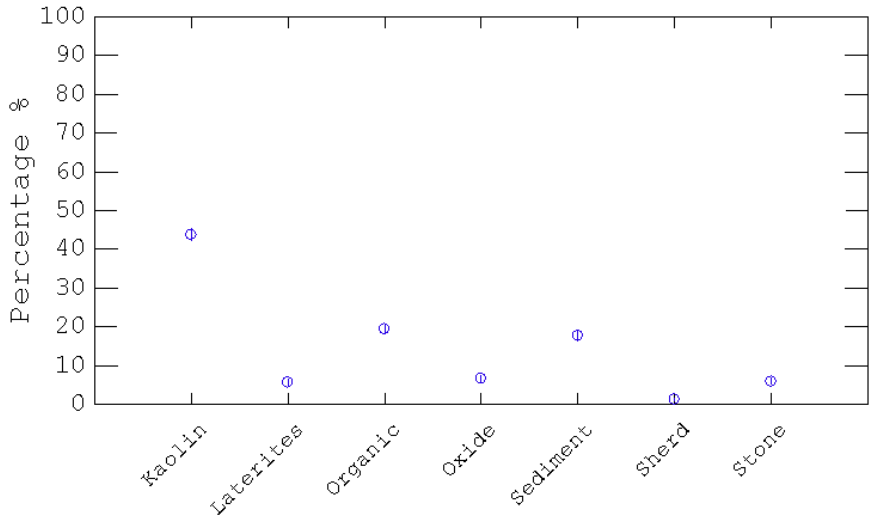

Figure 2.10 Sherd proportion by temper. Level 6 to 12. Test CA-CT-CE07.

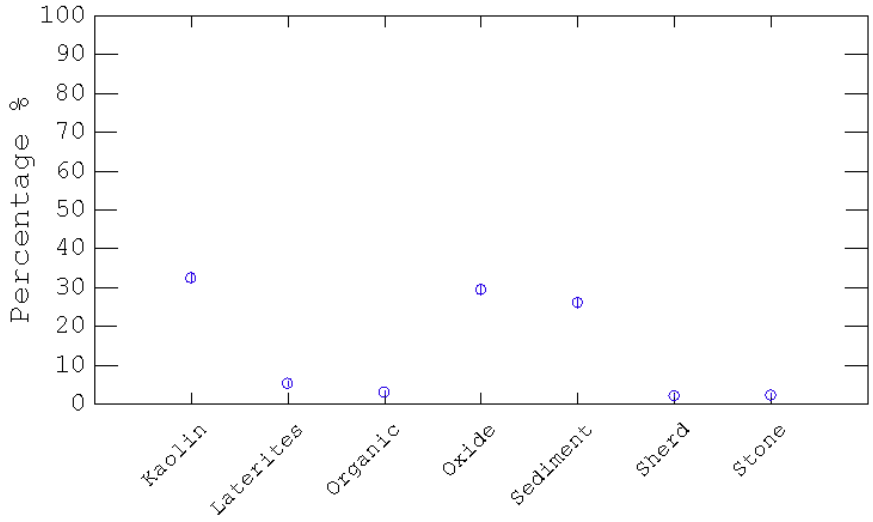

Figure 2.11 Sherds proportion by temper. Level 0 to 5. Test CA-CT-CE07.

The area in which test CA-CT-CE-07 was located was plowed several times during the last decades. For that reason, it is likely that the materials in the superficial levels could have been mixed through time as an effect of the use of a mechanical plow which could remove material from the lower levels to the ground surface (a mechanical plow can remove 30 - 35 cm from the

surface in average). It is also possible that many other processes have brought materials up and down within the archaeological deposits as a product of human, animal and plant activity. The result is that a clear separation of periods in the superior levels does not exist. Nevertheless, it is possible to observe some tendencies in the different concentration of temper material at those levels.

The increase in the number of sherds tempered with oxides and sediments in levels 0 to 5 is pretty clear, however, the high proportion of kaolin obscures this tendency. If it was the case, the proportions of kaolin and oxide could be inverted. What is possible to observe is that at level 6 (30-35 cm deep) sherds tempered with oxides show high proportions, but in levels 4 and 5 (20-30 cm deep) the proportions of oxides decrease abruptly while sherds tempered with kaolin proportions increase. In levels 2 and 3 (10-20 cm deep) again oxides increase while the proportions of kaolin decrease dramatically. Finally, from level 1 to 0 (0-10 cm deep), again the proportions of sherds tempered with oxides are lower than sherds tempered with kaolin which again shows an important increase. This pattern reveals that as an effect of the use of a mechanical plow, the ceramic materials from the lower levels that are tempered with kaolin appear deposited at the surface levels while the sherds tempered with oxides that were deposited originally at the superficial levels, now appear at the lower levels.

Based on the previous analyses, sherds tempered with organic fibers were assigned to the earliest occupation or Catanga Early Period, sherds tempered with kaolin to the middle occupation or Catanga Middle Period and sherds tempered with oxides and sediments to the late occupation or Catanga Late period.

Some temper materials such as crushed stone, laterites and crushed sherds were analyzed independently to observe the variation of their proportions through time by level. Each proportion was estimated taking into account the total of sherds by level including all temper materials (row proportions).

The high proportion of sherds tempered with laterites appears in level 1 (5-10 cm deep) (Figure 2.12). Although levels 6 and 8 present important concentrations of laterites, it is very likely that is just an effect of the subsoil removal. In consequence, laterites have had assigned to the Late occupation.

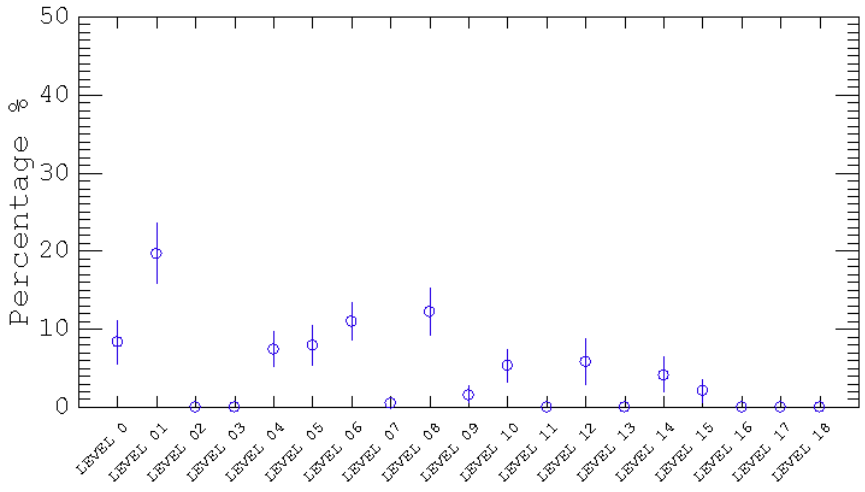

Figure 2.12 Proportions of sherds tempered with laterites by level. Test CA-CT-CE07

The higher proportions of sherds tempered with crushed stone appeared from levels 7 to 12 (35 – 65 cm) which correspond to the middle occupation of the area (Figure 2.13). However, during the early occupation crushed stone also was used frequently. Despite this, the higher

proportions are concentrated in levels 7 to 12 and in consequence sherds tempered with crushed stone were assigned as indicators of a middle occupation.

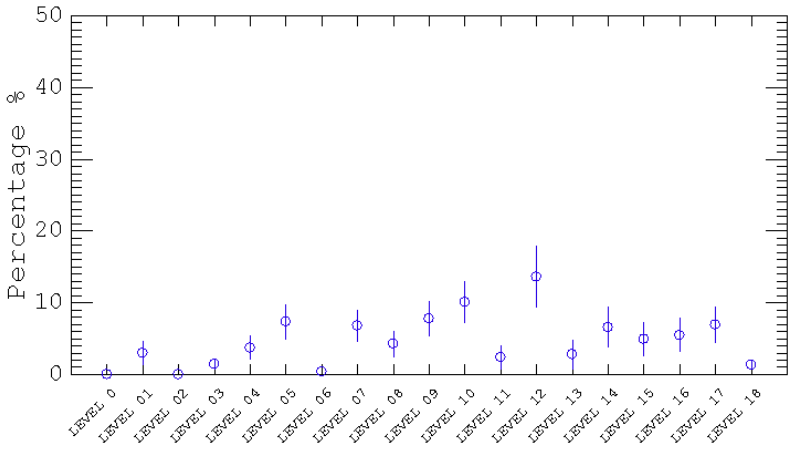

Figure 2.13 Proportions of sherds tempered with crushed stone by level. Test CA-CT-CE07

In the case of sherds containing crushed sherd as temper, the analysis of row proportions does not reveal a clear tendency (Figure 2.14). The larger proportions of crushed sherd suggest that this temper material was used more frequently during the late occupations.

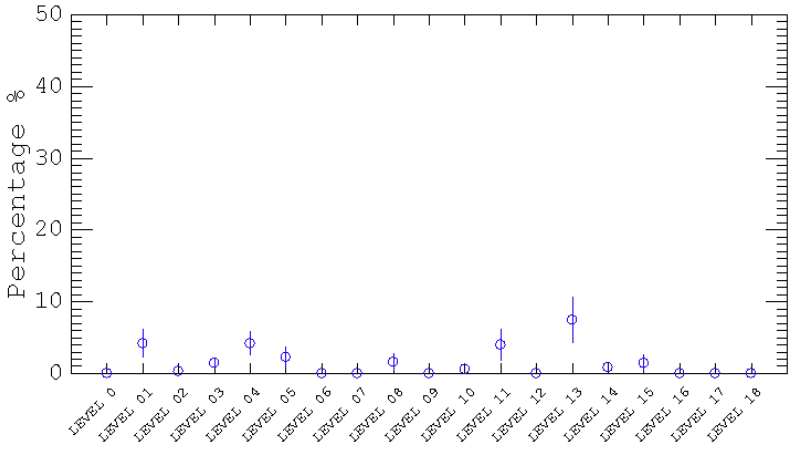

Figure 2.14 Proportions of sherds tempered with crushed sherd by level. Test CA-CT-CE07

In sum, during the Late Catanga period, materials such as oxides, laterites, sediments and crushed sherds were used to temper ceramics. In the Middle Catanga period the main temper material was kaolin and in very less proportion crushed stones. In Early Catanga times, organic fibers were the most used material to temper ceramic vessels for the ancient inhabitants of Catanga region.

Test CA-CT-CE-07 contains evidences of at least three different occupations through time. It is likely that all of them were accompanied of a feast according with the great quantity of fired faunal bones. Mound construction, some imported valuables such as a metal earring and lithic artifacts, and the presence of polychrome ceramic artifacts suggest that the area was occupied by different generations of an elite family.

2.3.2 Test CA-CT-CE-08

Test number 08 was located at the southern part of the archaeological site of Catanga. During the intensive survey of this zone a huge concentration of archaeological materials was detected through shovel test probes. Based on these findings the area was selected to conduct a stratigraphic test 1 m by 1 m. In the case of this test it was possible to observe three different strata, however, strata 1 and 2 appeared mixed probably as a consequence of subsoil removal in the area. The excavation was conducted until 1.20 m deep although the cultural materials reached 80 cm deep. In this test, it was possible to observe three strata clearly defined (Figure 2.15).

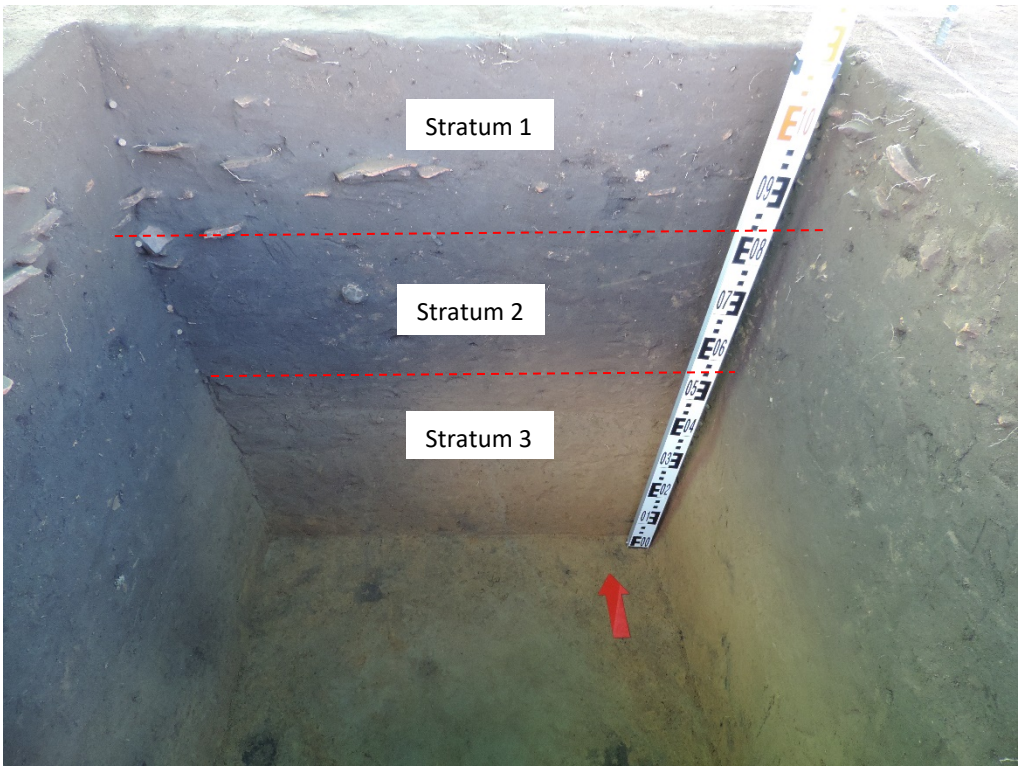

Figure 2.15 North Profile, Test CA-CT-CE-08.

2717 sherds were recovered during the excavation of test CA-CT-CE-08. The concentrations of ceramics vary according to depth. From deep to superficial levels it is possible to observe a continuous increase in the amount of ceramics (Figure 2.16).

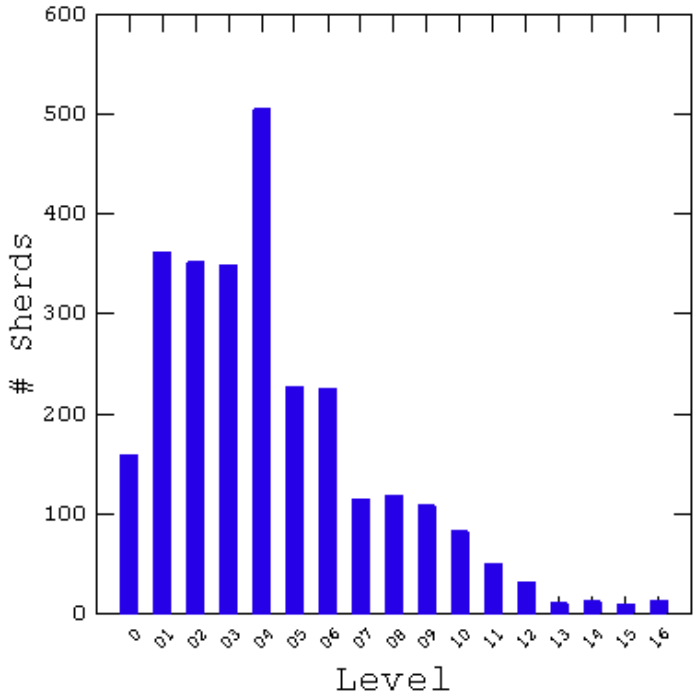

Figure 2.16 Concentrations of sherds by arbitrary level of excavation. Test CA-CT-CE08.

2.3.2.1 Temper Analysis. In the case of organic fibers, the analysis by level shows the higher proportion of this material in level 14 (Figure 2.17). The small quantities of sherds tempered with organic fibers produce large error ranges and for that reason it is difficult to observe a clear tendency. However, like in test CA-CT-CE-07 is possible to affirm that organic materials were used with more frequency during early times.

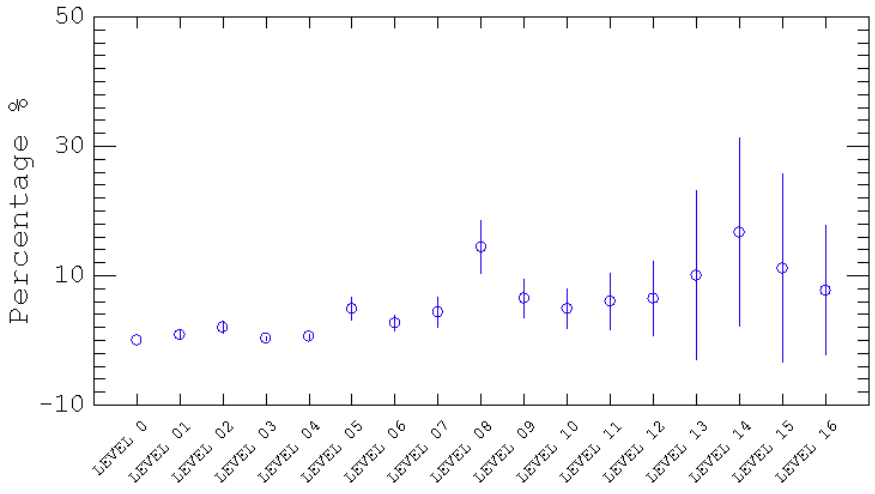

Figure 2.17 Proportions of sherds tempered with organic fibers by level. Test CA-CT-CE08

Kaolin is the temper material that appeared more concentrated at intermediate levels, from level 4 to 10 (Figure 2.18). Although at levels 14 and 15 there are some sherds tempered with kaolin, they are scarce as is evident in the large error ranges they produce. In the superior levels sherds tempered with kaolin exhibit lower proportions. This result indicates that as in the case of test number 7, kaolin was a temper material used more frequently during Middle Catanga times.

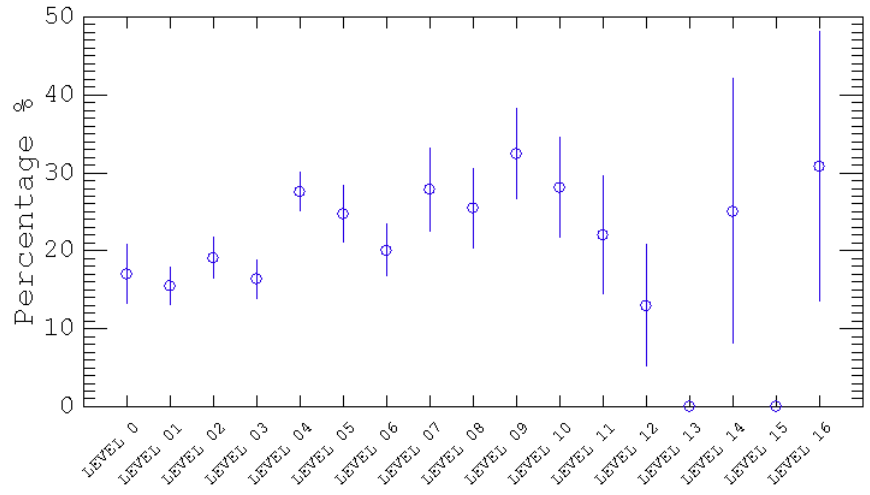

Figure 2.18 Proportions of sherds tempered with kaolin by level. Test CA-CT-CE08.

In the case of oxides, they appeared concentrated in high proportions at superficial levels 0 and 1 (Figure 2.19). From levels 2 to 10 the proportions diminished although remaining high. At the lower levels, the proportions diminished and the error ranges increase. This result is consistent with what was observed in test number 7, and it suggests that oxides were used as temper more often during Late Catanga times.

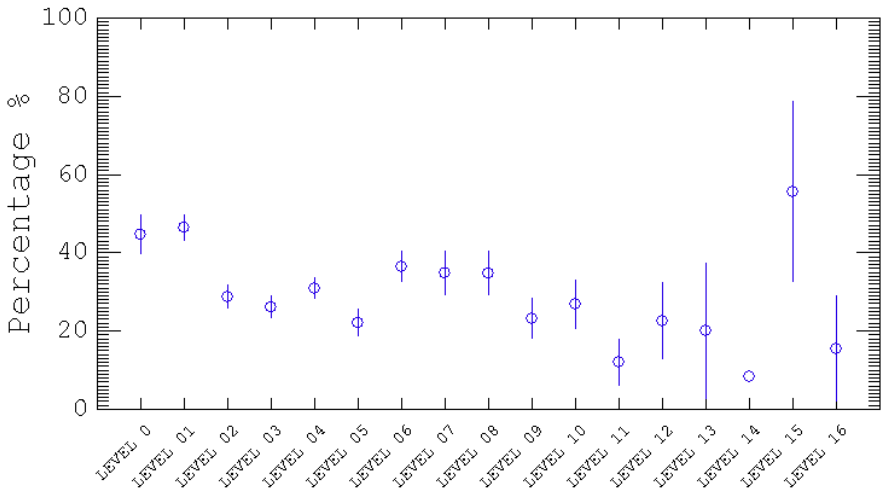

Figure 2.19 Proportions of sherds tempered with oxides by level. Test CA-CT-CE08.

Sediments appeared concentrated at high proportions in the deepest levels (Figure 2.20), however the error ranges are too large as a result of the reduced number of sherds recovered at those levels. In this case, there is no clear tendency to locate sediments in a specific chronological position. Despite this, I decided to assign sediments to the late occupation like in test number 7 because error ranges are too large at deepest levels and because sherds tempered with sediments diminished in the mean levels.

The highest proportion of laterites is present in the superficial levels (Figure 2.21). There is a decreasing tendency from level 7 to 10 in the proportion of sherds tempered with laterites. Levels 11 to 16 present large error ranges. Based on this information, laterites correspond to the late occupation like in test number 07.

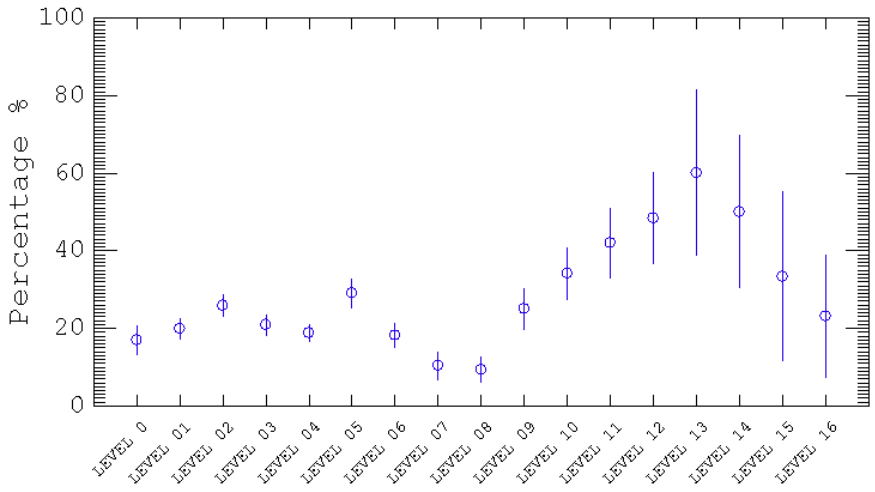

Figure 2.20 Proportions of sherds tempered with sediments by level. Test CA-CT-CE08

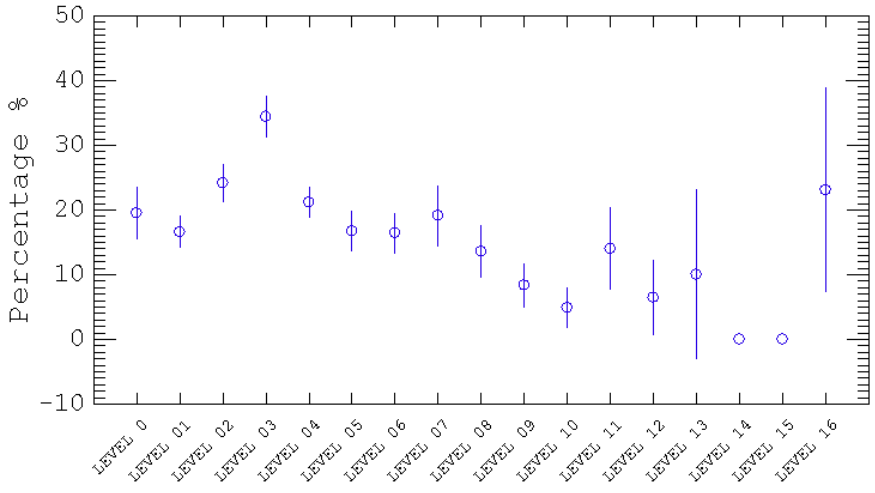

Figure 2.21 Proportions of sherds tempered with laterites by level. Test CA-CT-CE08.

As in the case of test number 07, crushed stone was not used very often as temper material across the stratigraphic sequence (Figure 2.22). The higher proportions are located at the intermediate levels (6-12). In the superior levels, the proportions are very low and in the inferior levels there was no presence of sherds tempered with this material. In this case, crushed stones were used to temper during the middle occupation.

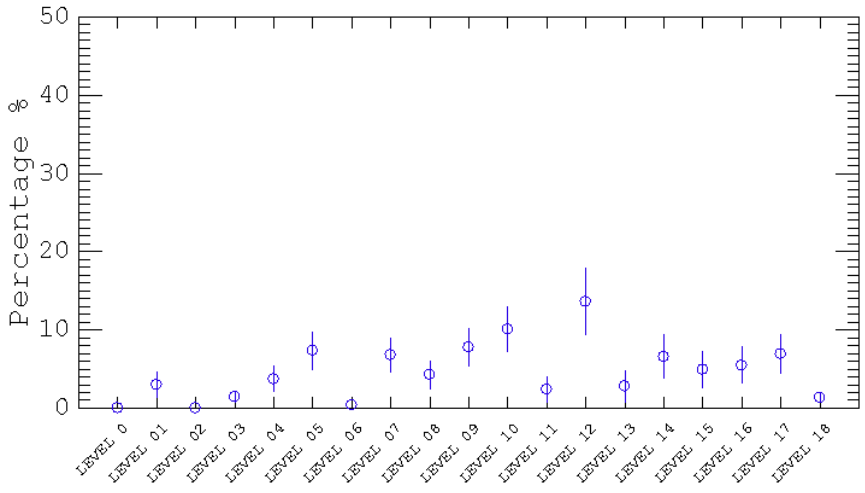

Figure 2.22 Proportions of sherds tempered with crushed stone by level. Test CA-CT-CE08.

The analysis of temper materials from test CA-CT-CE-08 shows a similar pattern of distribution than test CA-CT-CE-07. During the Late Catanga period, materials such as oxides, laterites, crushed sherds were used to temper ceramics. Although sediments appeared in high proportion at deepest levels, the large error ranges they produce, and their proportions on superficial levels suggest that this temper material was used more frequently during Late Catanga times. In the Middle Catanga period, kaolin was the main temper material and in a smaller proportion, crushed stones. In Early Catanga times, organic fibers represent the typical material used by the ancient inhabitants of Catanga region to temper ceramic artifacts.

The proportions of ceramic materials suggest that the area began to be settled just before Middle Catanga period; it remained occupied continually until Late Catanga times. There are no changes in the frequencies of sherds through the entire sequence that suggest discontinuities in occupation.

2.3.3 Test CA-EA-CE-04

This test was conducted at the east zone of the archaeological site of El Arenal. Close to the area of excavation, there is a mounded earthwork structure of approximately 25 m of diameter and 0.70 m in high which was detected during the intensive survey of the site (Figure 2.23).

Test CA-EA-CE-04 was located at the northwest of that mound and it was 1 m by 1 m. The shovel probes conducted in this area produced large quantities of archaeological remains such as ceramic, lithics and fauna bones.

Three strata were defined in the excavation (Figure 2.24). The first stratum appears between 0 cm and 15 cm soils were light brown and archaeological remains were not found on it. The second stratum includes the levels between 15 and 80 cm in which all the archaeological materials were recovered and recorded in this test. Finally, the deepest stratum exhibited yellowish clay soils with no presence of archaeological remains.

Figure 2.23 Mound CA-EA-MT-01. El Arenal archaeological site.

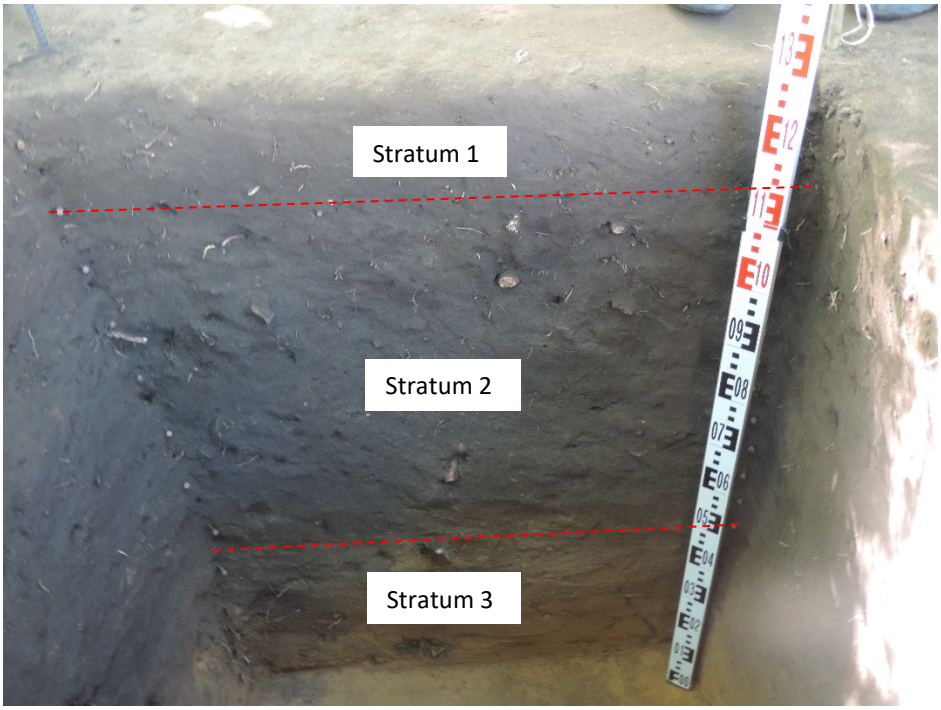

Figure 2.24 North Profile, Test CA-EA-CE-04.

Test CA-EA-CE-C4 reached 1.30 m in deep. Although the subsoil in this area has been removed and mixed in recent times, nowadays the relief is covered by forest. In total 2384 sherds were recovered during the excavation of this test (Figure 2.25). It is likely that levels 4 and 5 have been affected by the mechanical plow. Level 5 presents an important concentration of sherds. Beyond level 7 the concentration of sherds increases continually and it reaches their maximum peach at level 11. From level 12 proportions decrease until level 16. Archaeological remains were not present after this level.

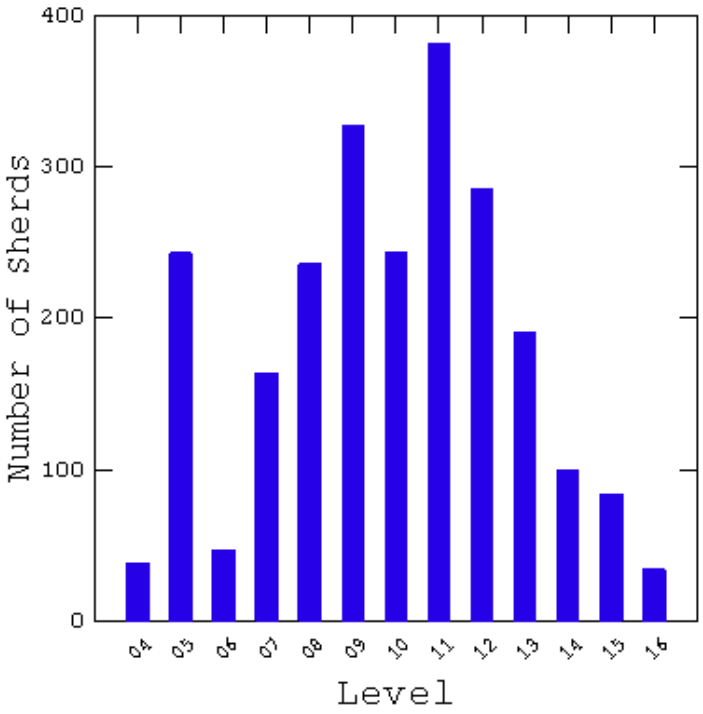

Figure 2.25 Concentrations of sherds by arbitrary level of excavation. Test CA-EA-CE-04.

2.3.4.1 Temper Analysis. Organic tempered sherds were concentrated at the deepest levels (Figure 2.26). From level 4 to level 11, the proportions of sherds remained low. At level 12 the

number of sherds increases. Levels 15 have the highest proportion of organic tempered sherds. These results suggest that organic fibers were used to temper during the early occupation.

Kaolin was present during all the stratigraphic sequence (Figure 2.27). At levels 4 and 5, this material presents high proportions but at level 6 its presence decreases. Levels 7 and 8 exhibit similar high proportions. Below 40 cm the proportions of sherds tempered with kaolin decrease constantly until level 13. However, at level 14 again the proportion of sherds tempered with kaolin increases. Finally, at levels 15 and 16 the kaolin's proportion decreases again. In this case kaolin has no defined position but tends to be concentrated in the superior levels.

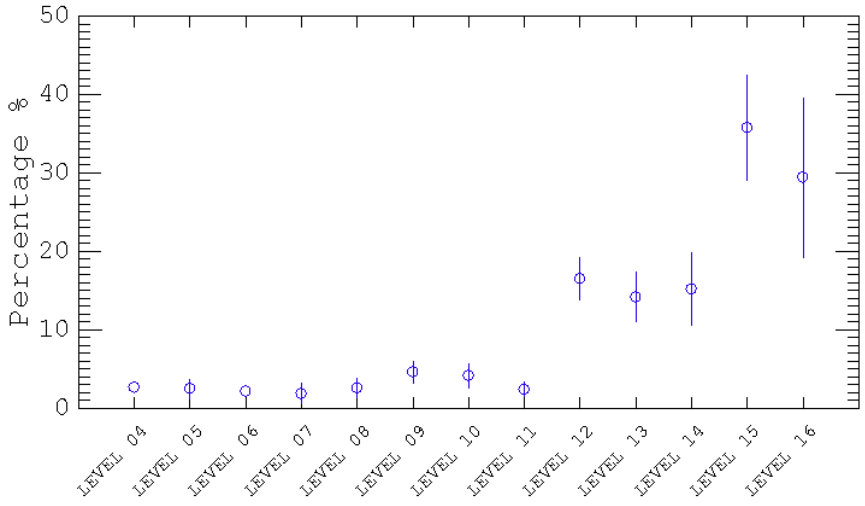

Figure 2.26 Proportions of sherds tempered with organic fibers by level. Test CA-EA-CE-04.

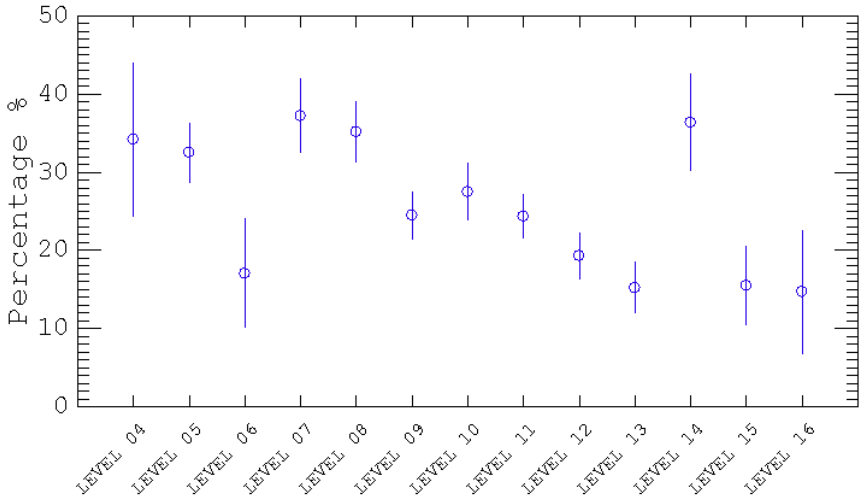

Figure 2.27 Proportions of sherds tempered with kaolin by level. Test CA-EA-CE-04

Oxides was a temper material used with high frequency across all levels at test CA-EA-CE-04 (Figure 2.28). Level 4 present the highest proportion. From level 6 to level 11 the proportions remain high. Although at level 12 there is a decrease in the proportion of sherds tempered with oxides at level 13 and 14, the proportions increase again. At levels 15 and 16, the proportions of oxides remain relatively low. In this case, the distribution of sherds does not show oxide associated to a clear stratigraphic position.

Laterites present a single picked distribution (Figure 2.29). From level 5 to level 9 the proportions of sherds tempered with laterites remain relatively low. At level 10 there is an important increase of sherds tempered with laterites. Below level 12 until the proportions decrease. Laterites appeared most concentrated at intermediate levels.

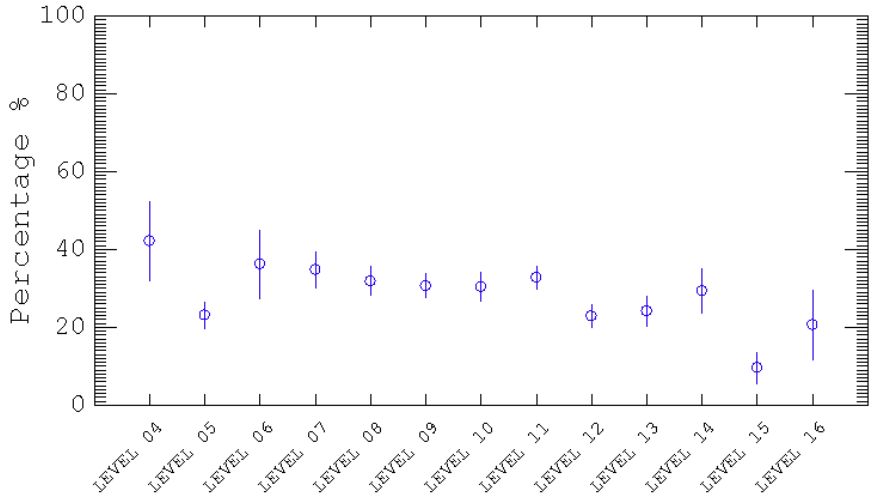

Figure 2.28 Proportions of sherds tempered with oxides by level. Test CA-EA-CE-04.

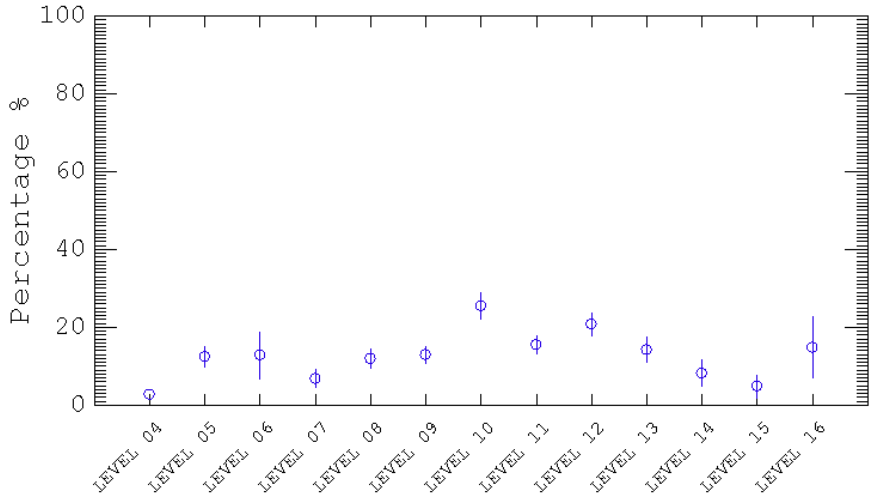

Figure 2.29 Proportions of sherds tempered with laterites by level. Test CA-EA-CE-04

The distribution of proportions does not show a clear tendency to allow allocate sherds tempered with sediments in a defined stratigraphic position (Figure 2.30). However, sediments were concentrated in greater proportions at levels 5, 6, 9, 13 and 15, what suggests that sediments were used with more frequency during Early and Late Catanga times.

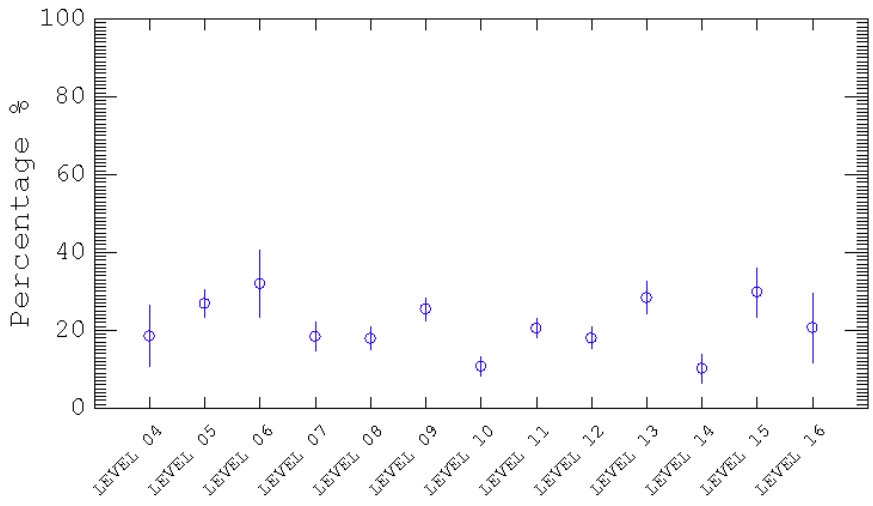

Figure 2.30 Proportions of sherds tempered with sediments by level. Test CA-EA-CE-04.

Pastes containing crushed stone as temper represent less than 5% by each level (Figure 2.31). The highest proportions appeared at deepest levels 11 and 15. This distribution suggests that crushed stone was not a material used during Late Catanga Times.

The analysis of proportions of sherds for levels at test CA-EA-CT-04 suggests a single occupation of the area that began at Catanga Early times which is indicated by the presence of sherds tempered with organic fibers. This occupation reaches its more intense peak between Early and Middle Catanga times, represented by a high peak in level 11 in which the proportion of organic temper diminished. From this level, proportions diminished toward the superficial levels indicating that from the Middle Catanga to the Late Catanga, the area was less intensely occupied. This pattern can be related with the construction of the mound.

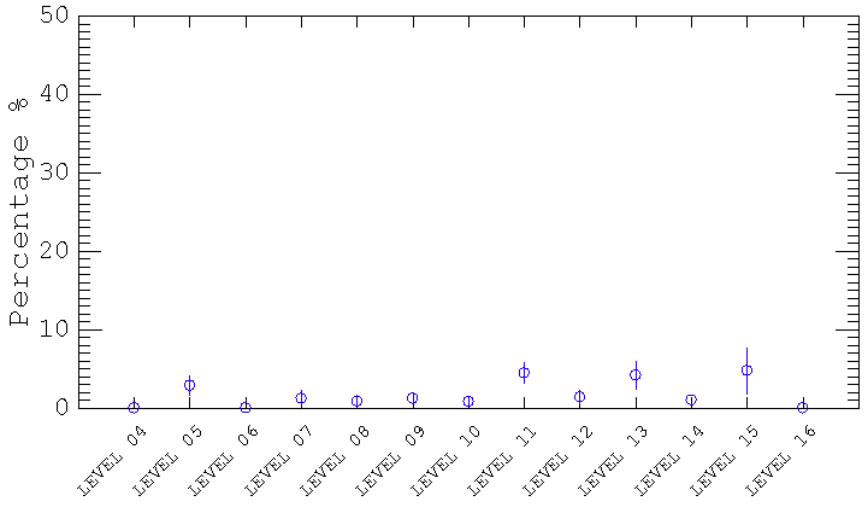

Figure 2.31 Proportions of sherds tempered with crushed stones by level. Test CA-EA-CE-04.

2.3.4 Test CA-EA-CE-06

This 1 m by 1 m test was located at the west part of El Arenal close to a second mounded structure recorded during the intensive survey of this archaeological site. Mound CT-EA-MT-02 was smaller than Mound CT-EA-MT-01. Its dimensions do not exceed 0.5 m high and 15 m of diameter. Test CA-EA-CE-06 was excavated until 1 m deep (Figure 2.32). Such as in other tests, only two strata were present, one composed by dark soils between 0 cm and 65 cm, the other, by yellowish clayed soils between 65 cm and 100 cm.

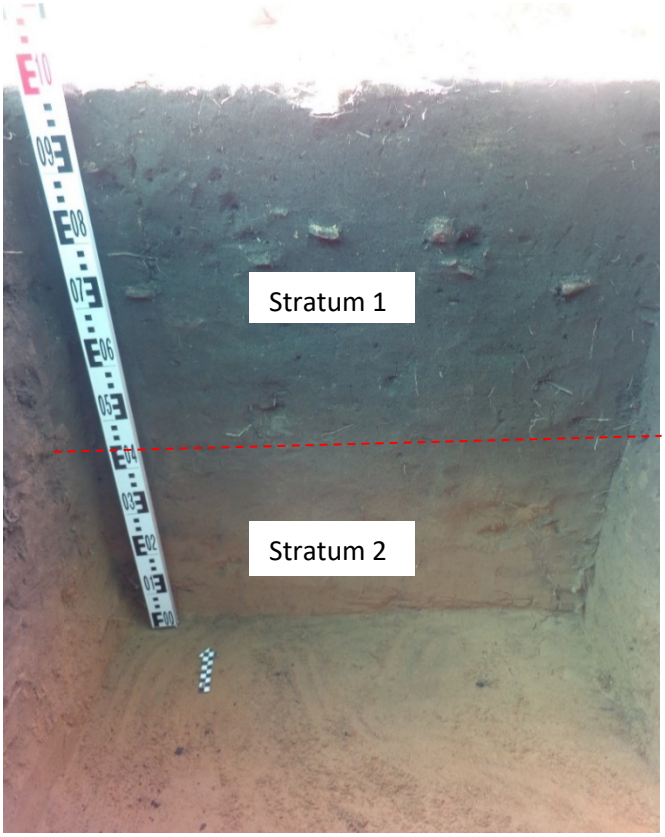

Figure 2.32 North Profile, Test CA-EA-CE-06.

From deep to superficial levels there was a continuous increase in the amount of sherds deposited, but at level 6, there was no presence of archaeological remains (Figure 2.33). It seems that this is a post-depositional phenomenon because the subsoil of this area has been perturbed recently. The highest concentrations of sherds correspond to level 0 and 1. Cultural materials were recorded from level 0 (0-5 cm) to level 13 (60-65 cm).

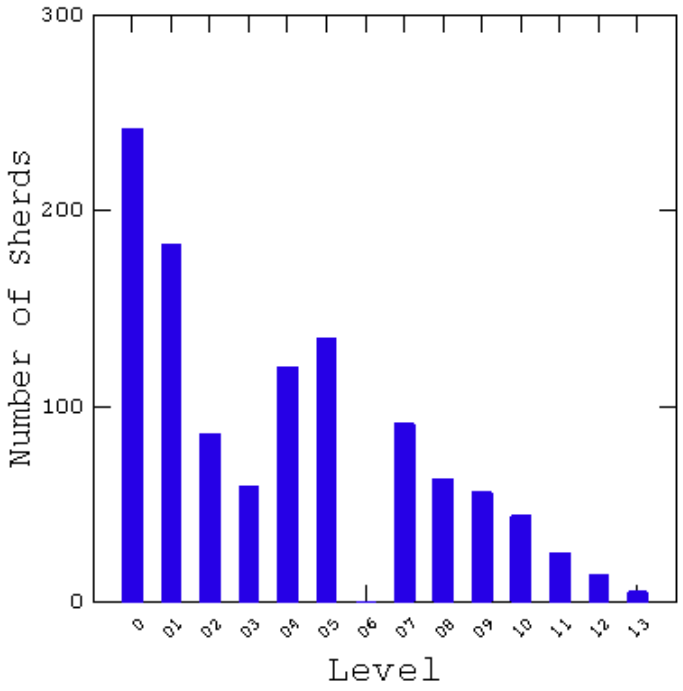

Figure 2.33 Concentrations of sherds by arbitrary level of excavation. Test CA-EA-CE-06.

2.3.6.1 Temper Analysis. Once more, organic temper was concentrated at the deepest levels below level 7 (Figure 2.34), however this value decreases at level 12. This distribution suggests, like in previous cases, the use of organic temper more frequently during early times.

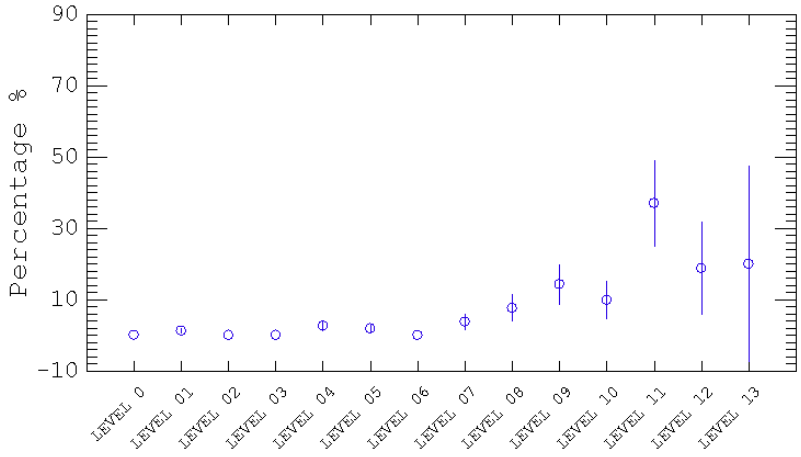

Figure 2.34 Proportions of sherds tempered with organic fiber by level. Test CA-EA-CE-06.

The greatest concentrations of sherds tempered with kaolin are present between levels 4 and 10 (Figure 2.35). Although level 0 and 1 display important concentrations of this temper material, in levels 2 and 3 the proportions lessen suggesting that the subsoil has been removed. It seems that kaolin was a material used with more frequency during Middle Catanga times.

Oxides are present in all the stratigraphic sequence; however, the high proportions of this material are concentrated in the superficial levels. At the inferior levels, the proportions decrease and the error ranges increase as an effect of the total number of sherds in each level, what suggests that this material were used mainly during the late occupation (Figure 2.36).

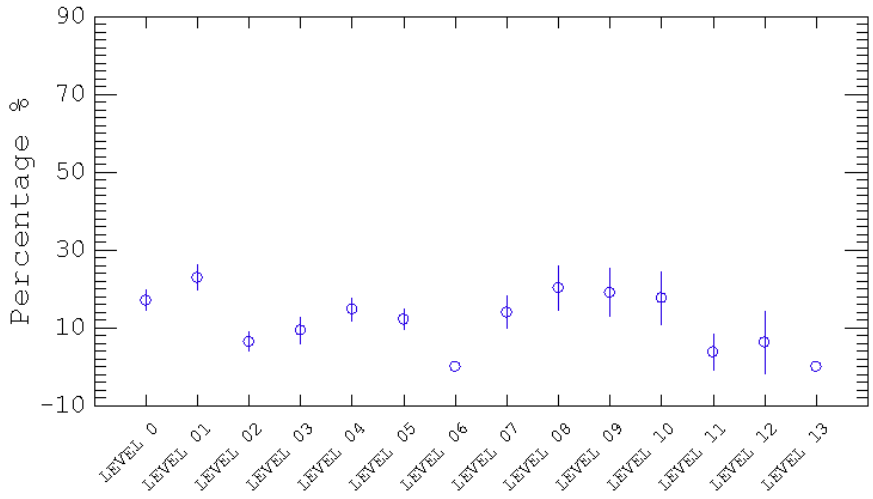

Figure 2.35 Proportions of sherds tempered with kaolin by level. Test CA-EA-CE-06.

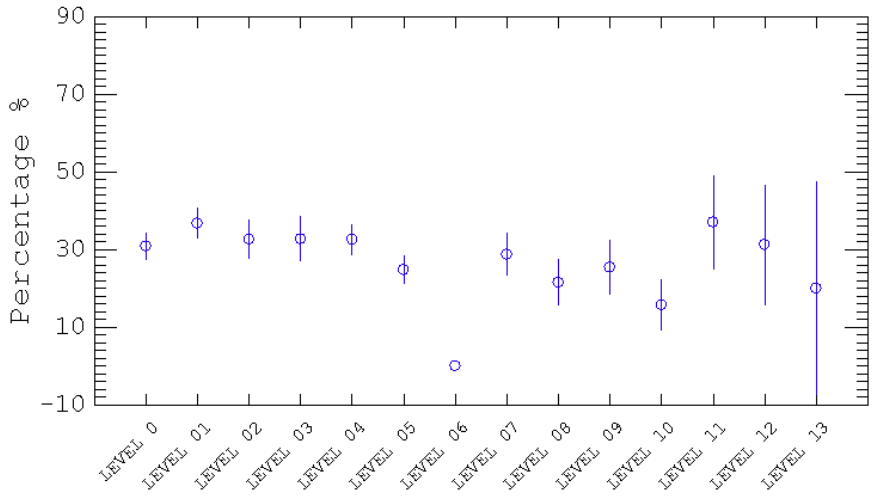

Figure 2.36 Proportions of sherds tempered with oxides by level. Test CA-EA-CE-06.

Level 0 represents the highest proportion of sherds tempered with sediments. Levels 2, 3 and 5 also include important amounts of sediments as temper (Figure 2.37). At the intermediate and deepest levels, there is also presence of this temper material; however, the proportions are lower. In sum, sediments were used more often during the late occupation.

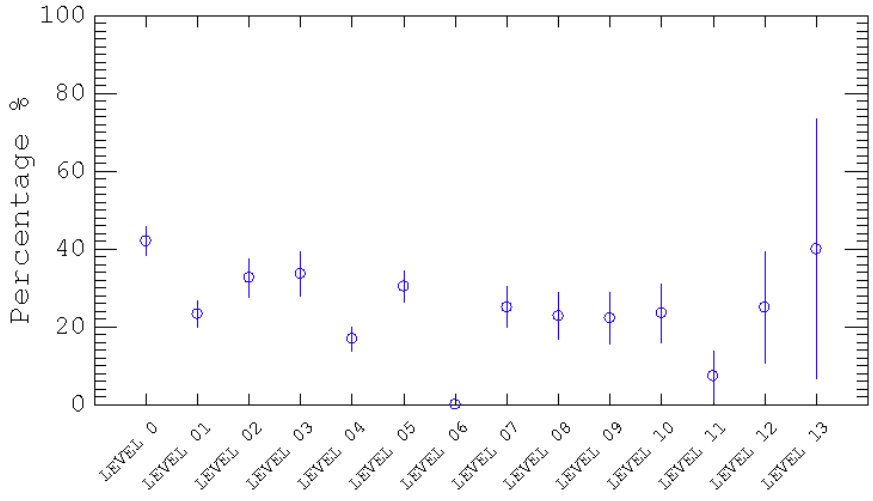

Figure 2.37 Proportions of sherds tempered with sediments by level. Test CA-EA-CE-06.

Laterites are concentrated in high proportions between levels 2 and 10 (Figures 2.38). The general pattern of distribution shows that the use of laterites increases gradually from level 4 through level 12. Below this level, the use of laterites diminished until level 0. This pattern suggests that from the early occupation laterites were increase in use until Middle Catanga times even to the beginning of the late occupation.

Crushed stone is a temper material that was concentrated in the mean levels from 5 to 10 (Figure 2.39). Although the higher proportion is present in level 12, its large error range makes useless this observation. Based on this pattern, it is very likely that crushed stone was a material used more often during Middle Catanga times.

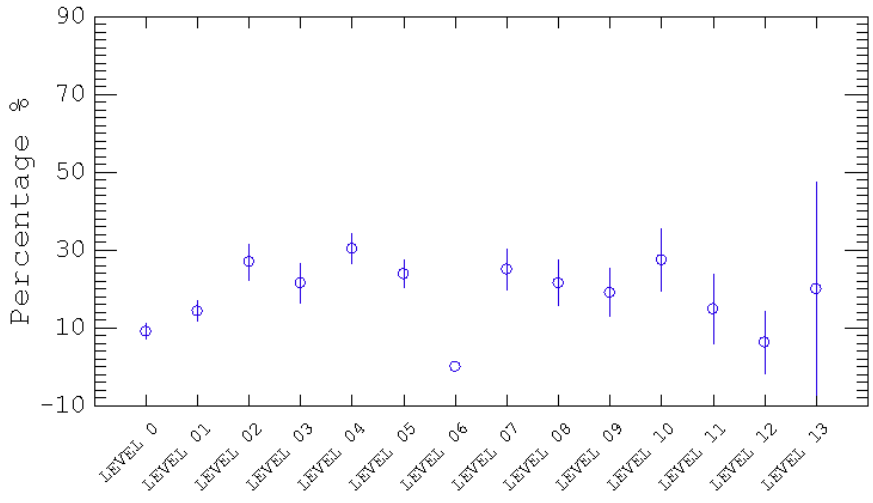

Figure 2.38 Proportions of sherds tempered with laterites by level. Test CA-EA-CE-06.

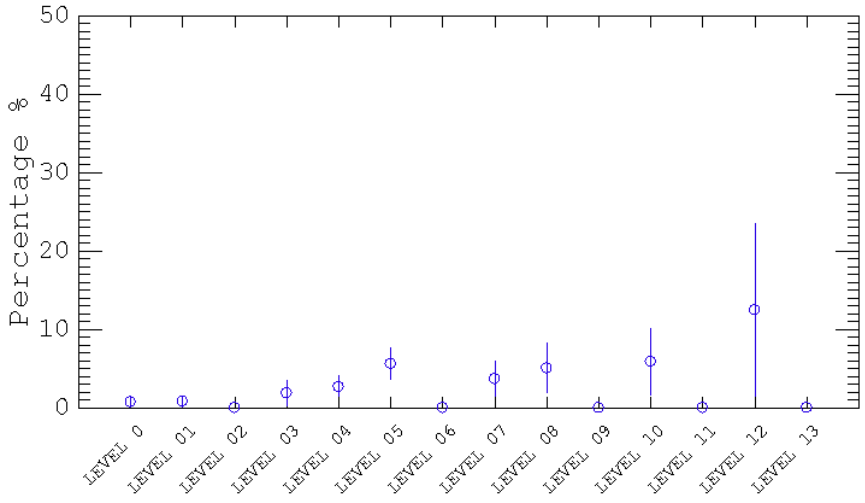

Figure 2.39 Proportions of sherds tempered with crushed stones by level. Test CA-EA-CE-06.

Temper materials recovered during the excavation of test CA-EA-CE-06 present a similar distribution than tempers in test CA-CT-CE-07. Oxides, laterites, and sediments appeared associated to the late occupation. Sherds tempered with kaolin and crushed stone likely represent the middle occupation while sherds tempered with organic fibers represent the early occupation. Crushed sherd was not present among the temper materials recorded in the area. The stratigraphic pattern of sherd distribution suggests that the early occupation had a short span, and that it is likely that the area was used more intensely during Middle Catanga and Late Catanga times. It seems that the construction of CT-EA-MT-02 occurred sometime between Middle and Late Catanga period. The occupation of this area was continuous across three periods.

2.4 SUMMARY OF CHRONOLOGY

The analysis of the ceramic materials from the archaeological sites of Catanga and El Arenal has provided the classificatory scheme to date every settlement in the study region. The allocation of simple sherds to any of the three archaeological periods proposed to the region, Early Catanga, Middle Catanga and Late Catanga, is possible in the proposed system taking into account that temper was prioritized to organize ceramic artifacts in groups. Temper demonstrated a consistence in stratigraphic terms that allow the assigning of a chronological period to every sherd recovered during the regional survey. The classificatory system is summarized in Table 2.2.

The relative dating associated to each chronological period is proposed over the basis of the analysis of 5 of 110 charcoal samples recollected during the excavation of test CA-CT-CE-07 (Table 2.3).

Table 2.2 Proposed Periodization with ceramic classificatory scheme.

Period	Date (A.D)	Typical Temper Material
Late Catanga	1400 -1600	Oxides, Laterites, Sediments, Crushed Sherd
Middle Catanga	1200 - 1400	Kaolin, Crushed Stone
Early Catanga	1000 - 1200	Organic fibers

Table 2.3 Report of radiocarbon dating. Beta Analytic.

Test	Sample	Depth	Measured Radiocarbon Age (2-sigma calibration)
CA-CT-CE7	C A C T C E 7 - N 7 - M 2 0	35 - 40 cm	Cal AD 1190 to 1275 (Cal BP 760 to 675)
	C A C T C E 7 - N 9 - M 3 6	45 - 50 cm	Cal AD 1035 to 1215 (Cal BP 915 to 735)
	C A C T C E 7 - N 1 3 - M 7 0	65 - 70 cm	Cal AD 1050 to 1085 (Cal BP 900 to 865)
	C A C T C E 7 - N 1 5 - M 8 2	75 - 80 cm	Cal AD 1025 to 1165 (Cal BP 925 to 785)
	C A C T C E 7 - N 1 8 - M 1 0 6	90 - 95 cm	Cal AD 1020 to 1155 (Cal BP 930 to 795)

The dates obtained are consistent among them and indicate a continuous occupation from cal AD 1020 to 1275, represented by many different charcoal accumulations between levels 7 to 18 (Figure 2.40). Because levels 0 to 6 have been perturbed recently, I did not consider the collected samples in those levels for radiocarbon dating analyses. However, during the excavations conducted by Mora and Márquez (1982) in the 1980's, a time where the area was not yet intervened intensely by the hacendados, they collected a charcoal sample from the superficial levels and obtained a date around AD 1600 +/- 50. Based on these results I defined the relative periodization.

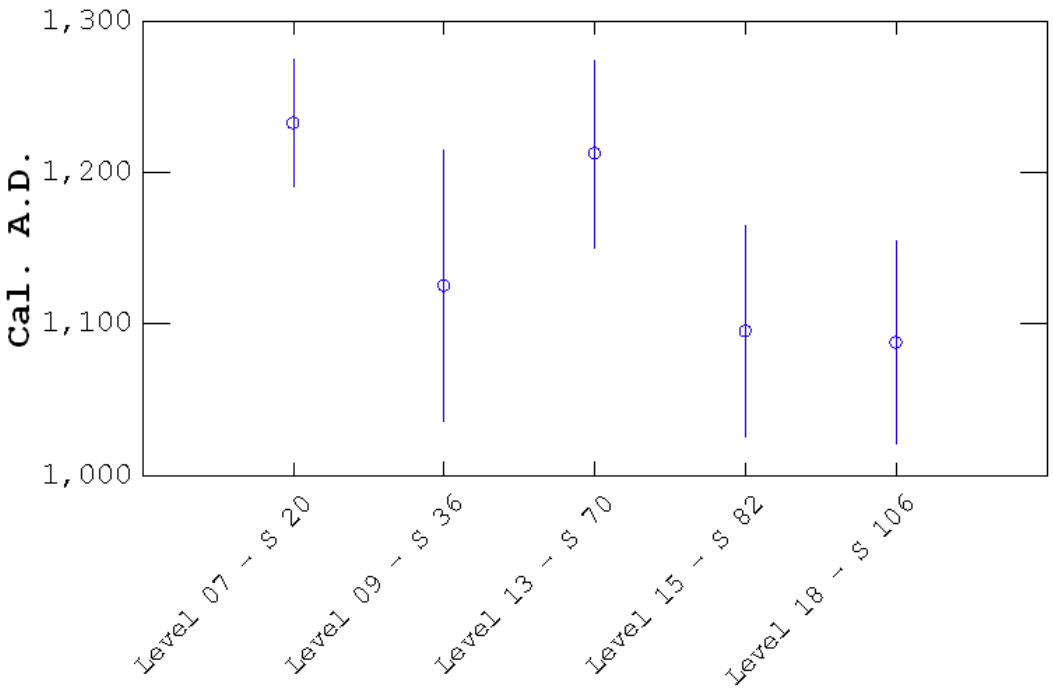

Figure 2.40 Radiocarbon dates obtained from the sample analyses from test CA-CT-CE-07.

Representation for 2 sigma calibration.

3.0 REGIONAL SETTLEMENT PATTERNS

The archaeological regional survey carried out in the Catanga region has provided information about nucleated settlements of different sizes and small dispersed farmsteads. The Early Catanga period corresponds to the earliest occupation that was detected in the study region. At this time, people were living in small nucleated sites such as Catanga, El Arenal, Corinto, El Pensil, Tilodirán and Santa Juana, and in small farmsteads such as sites CT2 and Tucuragua making a total occupation of 33 hectares. El Arenal, Corinto, El Pensil, and Tilodirán are 4-5 hectares in size while Catanga covers around 9 hectares (Figure 3.1). Tucuragua and Santa Juana are 2 hectares in size and the site CT2 was less than 1 hectare.

By Middle Catanga period, the larger sites continued growing and the occupied area had increased to 50 hectares. New small sites such as El Medano, CT3, Las Brisas, La Esperanza and EL Coco appeared in the region during this period. Catanga emerged as the large nucleated village in the region with an occupied area size of 11 hectares. El Pensil also increased in size and the ceramic distribution suggests an occupied area of 10 hectares but with an occupation less dense than in Catanga. El Arenal, Corinto, Tilodirán, Tucuragua and Santa Juana are between 3 – 5 hectares in size. The smaller sites are less than 2 hectares in size (Figure 3.2). During this period, it seems that Catanga emerged as the dominant community in the region.

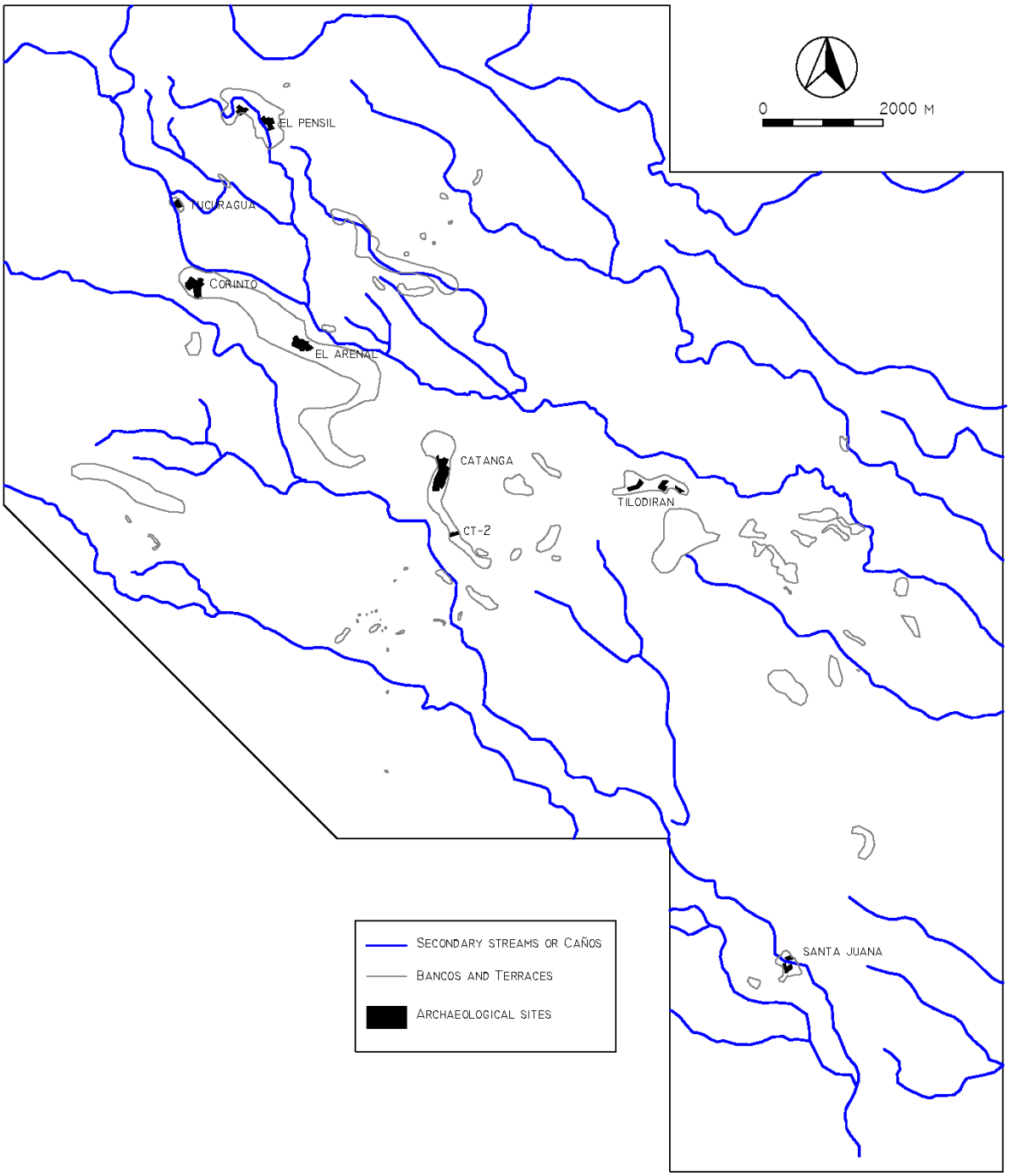

Figure 3.1 Settlement Patterns for Early Catanga period.

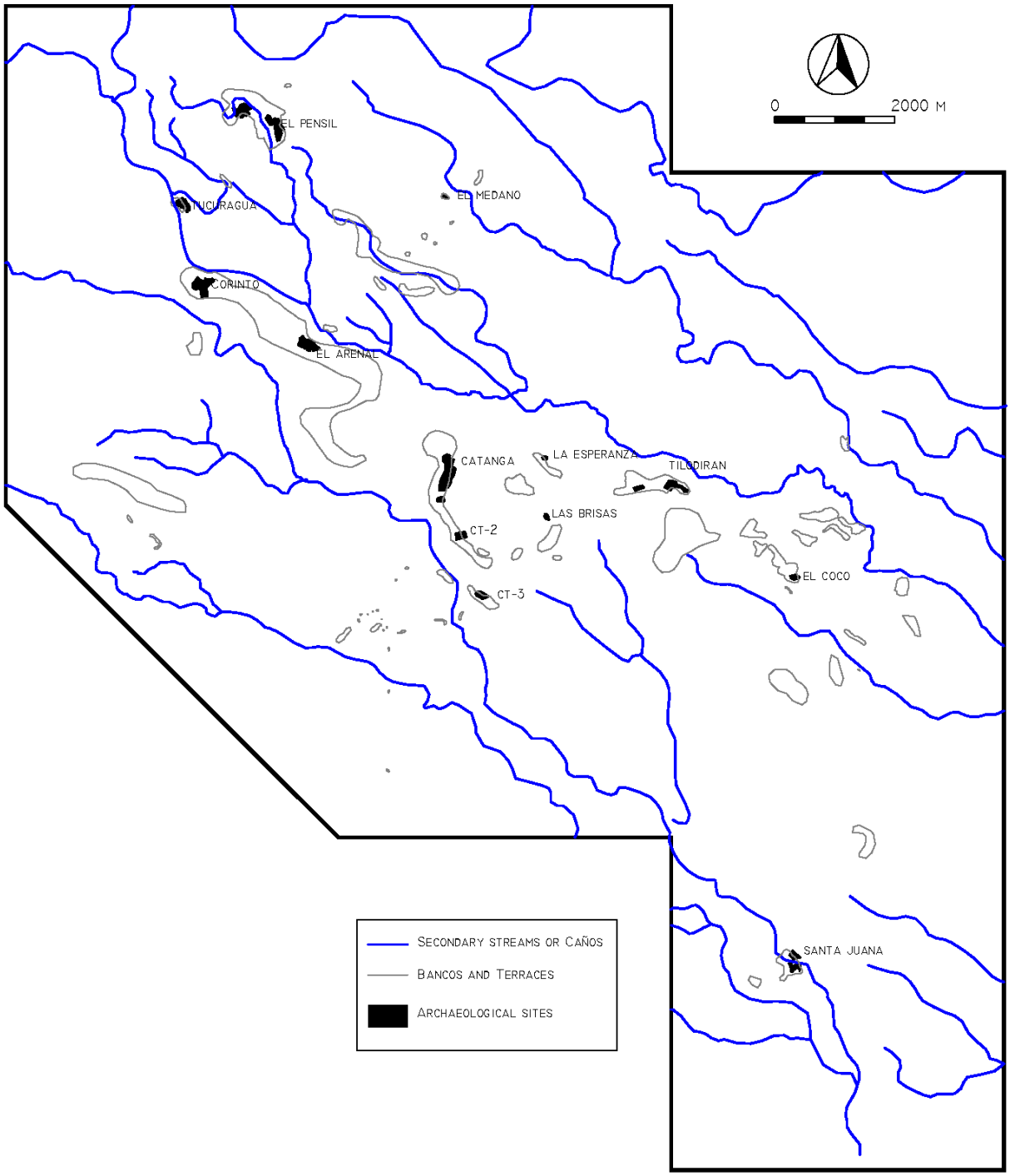

Figure 3.2 Settlement Patterns for Middle Catanga period.

Late Catanga period corresponds to the latest recorded occupation in the study area. During this period, sites continued growing and the total occupation was around 56 ha. The site of Catanga reached 13 hectares in size while El Pensil was 12 hectares. Although the size of the two sites is similar, the amount of cultural remains recovered was larger in Catanga than in El Pensil, this suggests a less dense occupation in the latter. The size of the smaller villages remained between 4-6 hectares, and some of the smaller and dispersed sites, such as Las Brisas and CT3 disappeared, and one new small site, El Viento, emerged in the region (Figure 3.3). The archaeological evidence suggests that during Late Catanga times, the Catanga site was still the dominant community in the region.

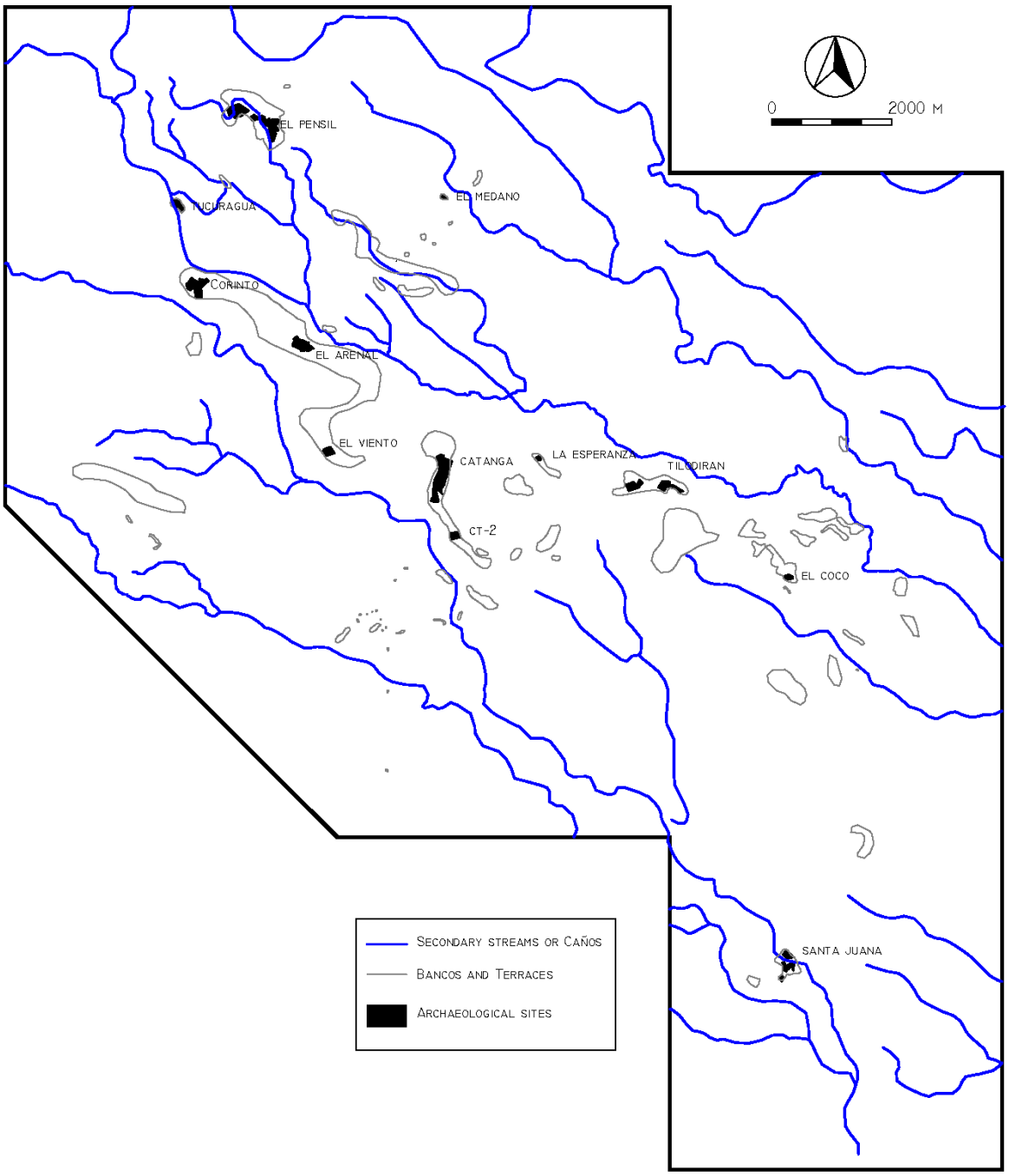

Figure 3.3 Settlement Patterns for Late Catanga period.

3.1 REGIONAL DEMOGRAPHY

The approach to estimating prehistoric populations is based on Drennan *et al.* (2015) and Drennan and Peterson (2011). Drennan *et al.* (2015) has suggested that social interaction is affected and constrained by population size. One of the main goals of this research has been to define what was the nature and the patterns of interaction that pulled people together in the Catanga region. To achieve this goal, it was necessary to determine how people were distributed spatially. It is expected that in a regional setting, there are places where more people were concentrated and others where less people were settled in. The differences in the number of people living in different areas at the same time, can be related with different forms and structures of interaction that can be expressed at different scales. In consequence, it is necessary to estimate how many people were living in a place during a period. Drennan and Peterson (2011) have proposed a correlation between the number of people living in a place and the amount of garbage produced by these people through time. The basic assumption is that, the greater amounts of garbage in an area, the more person-years of occupation occurred in that place (Drennan *et al.* 2015: 35). If so, it is expected that in those areas of a settlement in which large amounts of artifacts accumulated per hectare, more people per hectare were living. Based on this assumption, Drennan and Peterson (2011) have proposed to measure the differences in the amount of sherds per hectare deposited during the period to which those sherds pertain, using an area-density index. The use of the area-density index allowed me to determine if there were demographic differences within and between the local communities recorded in the study area

through time. Different artifact densities could be indicators of the presence of powerful individuals in the communities.

Maschner and Bentley (2003: 53) have argued that house size is directly correlated with the number of residents and hence to the power of the headman. These authors discuss that one of the characteristics of headmen is that they invest time, resources and energy trying to increase their influence and authority maintaining the size of their kin group. Then, it is expected that as an effect of the leadership attraction, some areas within the settlements concentrate more garbage as an indicator of more people living there. This same pattern was expected between sites. The area-density index was useful in developing this task.

During the regional survey carried out in the Catanga region, the collection lots defined provided an estimate of the occupied area by period, which was the result of the sum of the collection lots containing sherds of every one of the three periods defined for the region. Following Berrey (2014: 32), sherd densities were calculated for individual shovel probes, by dividing the total number of sherds that were associated with each phase by the total area of the probe that was excavated (about 0.16 m^2). Sherd densities were then divided by the number of centuries in each phase to standardize their values. An advantage of using this methodology is that the area-density index reveals a greater range of variation in settlement populations (Drennan *et al.* 2015: 35) which is important for studying leadership attraction.

The next step was to estimate how many people produced the number of ceramic artifacts calculated for each collection lot. Berrey (2014) has proposed based on four communities from the Intermediate Area (Mesitas, Suta and El Venado, Colombia and Barriles,

Panama) four categories to correlate the density-area index with number of persons per hectare. In general terms, densities between 0-14 sherds/m^2/century correspond to 5-10 people/ha, densities between 15-34 sherds/m^2/century correspond to 10-15 people/ha, densities between 34-55 sherds/m^2/century correspond to 15-20 people/ha and densities superior to 55 sherds/m^2/century correspond to 20-30 people. Although these categories are useful to estimate population in regions with low indexes values, in regions with high indexes produced by nucleated villages like in the case of Catanga, their use represents a problem. For instance, in the site of Catanga, there are some collection lots with densities around 60 sherds/m^2/century. Based on Berrey's scheme, the estimated population of those lots would be 25 people/ha. There are other lots with indexes above 100 sherds/m^2/ha with the same 25 people/ha based on Berrey's projections. In those cases, the categories correlated with the area-density indexes do not represent the range of variation in the region, especially in those lots with the larger concentrations of artifacts which could represent areas of leadership activity.

A continuous scale was developed following the procedure described by Drennan *et al.* (2015: 112-114) to avoid the problem derived of the use of categories. To do this, the data analyzed by Berrey from the four communities of the Intermediate Area (Mesitas, Suta and El Venado, Colombia and Barriles, Panama) was used. In addition, I have included new data from the archaeological excavations at the regional center of the El Gaván region (site B12) in the Llanos of Barinas (Spencer and Redmond 2014), that is a large nucleated village which exhibits large concentrations of artifacts in some of the internal areas like the large settlements in the Catanga region.

The first step was to locate every area-density index obtained by each community during a period in a continuous line. These values covered a wide range. It is possible to observe three ranges of values, low, middle and high. Low values are represented by area-density indexes below 10 sherds/m^2/century, and the communities of Suta (Late Muisca period) and Mesitas (Regional Classic period) are included in this group. The second group is composed by the communities of Suta (Early Muisca period), Barriles (Early Bugaba and Late Bugaba periods) and El Venado (Abejas-Late Muisca Period) which exhibit index values around 20 to 30 sherds/m^2/century. The group with the highest values represents densities above 80 sherds/ m^2/century and includes the communities of El Venado (La Esmeralda – Early and Late Muisca periods) and El Gaván (Late Gaván period) which present the highest value of all cases on this graphic scale. The next step was to locate on a continuous scale the absolute population densities represented in persons per hectare associated with every area density index graphed (Figure 3.4).

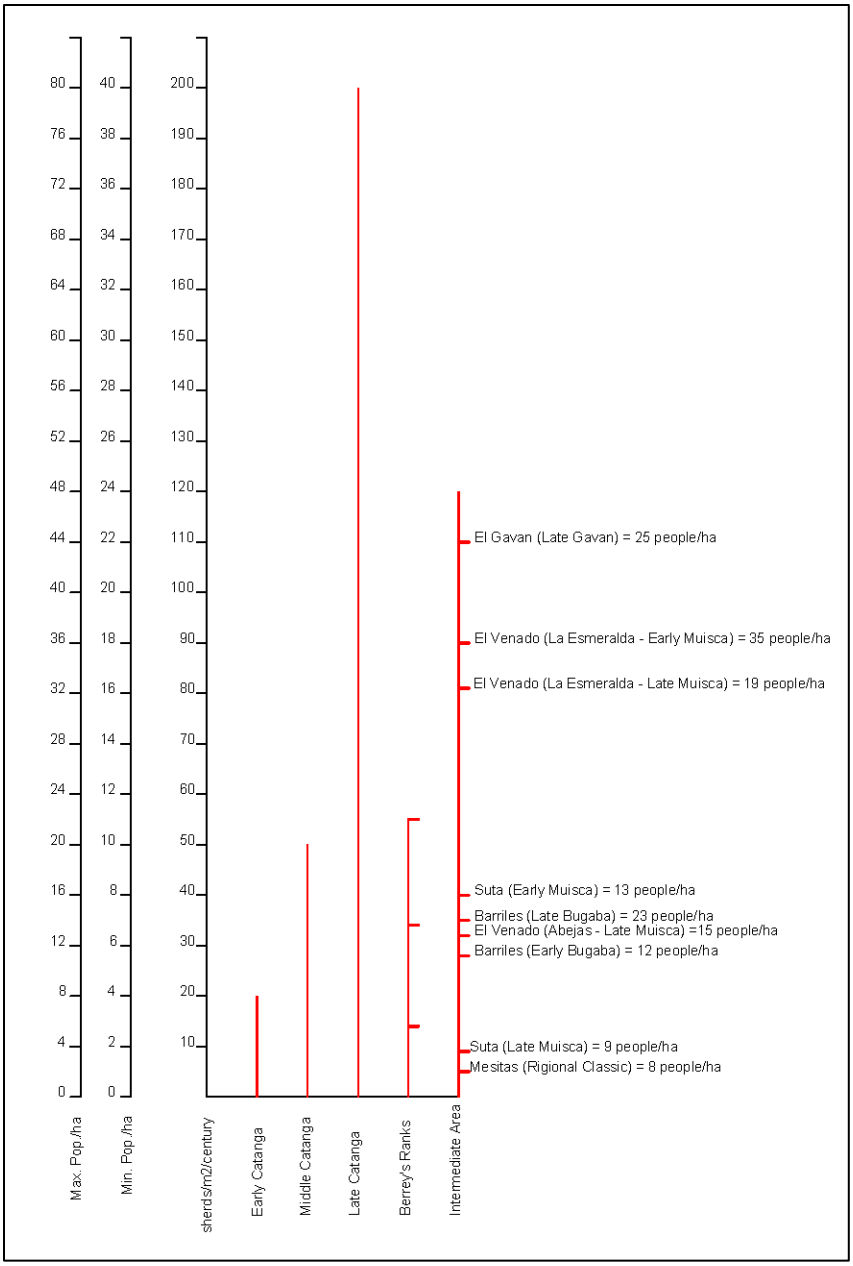

Figure 3.4 Scale of ranges of area-density values recorded for the Intermediate Area.

Once the scale was located, it was determined that multiplying the area-density index by 0.4 produced a number on the estimated population scale. The next step was to determine if this factor of 0.4 represents the minimum or the maximum population. An X-Y graph (Figure 3.5) was

developed by Drennan (2016, personal communication) in which the X-axis represents the area-density values and the Y-axis represent the population density. In this graph, the area-density index values and the associated population density of the Intermediate area local communities were located.

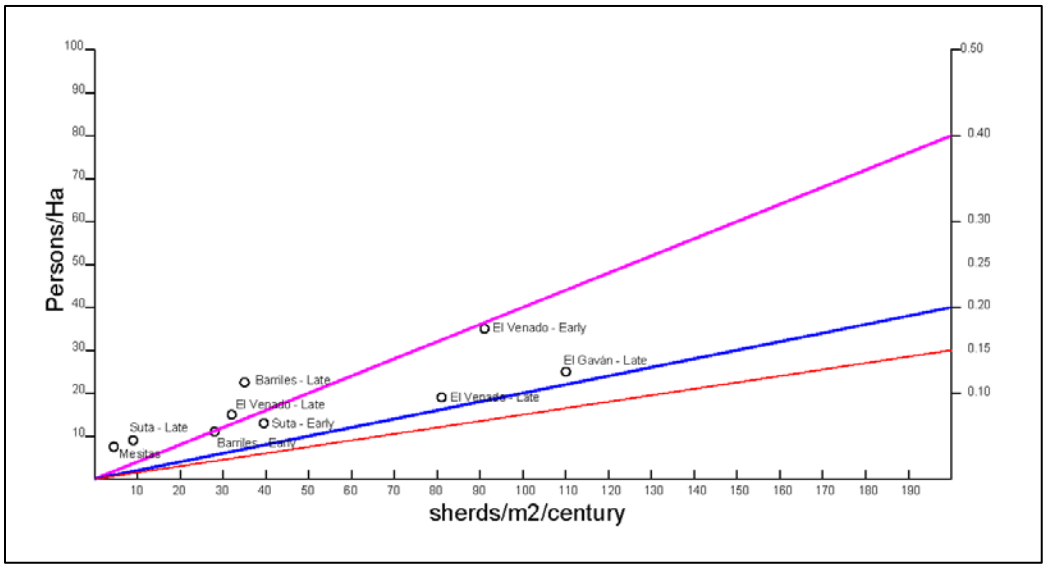

Figure 3.5 X-Y Graph representing area-density values recorded for the Intermediate Area with low and high conversion factors.

In the graph, it is possible to observe a purple line representing the conversion of the 0.4 factor. Most of the points representing the area-density index and the population density per hectare are relatively close to that line. However, the point representing El Gaván values is located far from that line. A red line representing a factor of 0.2 was graphed. This line passes very close to the point representing the highest area-density indexes, those from El Venado and El Gaván. Based on this observation, it was assumed that the factor of 0.4 represents well the

maximum estimated population scale and the 0.2 factor represents the minimum estimated population scale. This rank produces small error ranges when the area-density indexes are low and produces large error ranges in terms of the absolute numbers of people but not in terms of their proportions when the values are high (Drennan 2016, personal communication). This correlation provides a continuous scale of measurement as the basis to directly assign residential densities to the 101 collection lots delineated in the region. Using this scale, it is possible to make population density projections that reflect the full variability of the area-density index.

The demographic approximations suggest that there was continuous regional demographic growth from the Early Catanga period to the Late Catanga period (Table 3.1). The population during the Early period was less than 100 persons, represented by a few household units distributed across the landscape. Catanga, at this time, was probably a small nucleated village and its population was not much more than 40 people, even so, it was several times larger than the other sites that probably represent scattered farmsteads which were inhabited by less than 20 persons. During the Middle Catanga the regional population increased and probably around 200 individuals were settled in the region. Catanga was a large and dense nucleated village with a population less than 100 people. The larger farmsteads such as El Arenal, Corinto, El Pensil, Tilodirán and Santa Juana continued increasing and at that point were composed by a small number of families. Some small areas of bancos were occupied probably by one or two household units represented by very low area-density indexes.

Table 3.1 Estimated population associated with archaeological sites in the study area.

	Early Catanga		Middle Catanga		Late Catanga	
Archaeological site	**Size (ha)**	**Estimated Average population**	**Size (ha)**	**Estimated Average population**	**Size (ha)**	**Estimated Average population**
Catanga	8.4	31	11.1	80	12.8	288
El Arenal	4.88	13	4.9	26	4.9	114
Corinto	5.6	11	6.2	18	6.5	48
El Pensil	4.7	8	10	32	12.5	81
Tucuragua	1.6	2	3.2	7	3.2	4
Tilodirán	4	6	5	17	6	101
Santa Juana	2.12	6	3.4	14	3.8	82
Las Brisas	0	0	1.8	2	0	0
CT2	1	1	1.8	2	1.9	3
CT3	0	0	0.4	1	0	0
La Esperanza	0	0	1.2	2	0.7	1
El Coco	0	0	1	1	1	5
El Viento	0	0	0	0	1.8	4
El Medano	0	0	0.8	2	0.9	4
Total	32.3	78	50.8	204	56	735

During the Late Catanga period, the regional population was less than 1000 individuals. At this time, Catanga became the largest highly compact village in the region with a population around 300 people. El Arenal and El Pensil were also compact villages but they were smaller demographically than Catanga with an associated population around 100 people. Although El Pensil offered a continuous dispersion of ceramic materials pertaining to the late period comparable in size with Catanga (12 ha), the density of occupation was very much lower. The approximations suggest less than 100 people were settled in this dispersed village. These villages were accompanied by small farmsteads dispersed across the study area.

3.2 SUPRA-LOCAL ORGANIZATION

The delineation of large scale social formations or polities as an expression of regional leadership is one of the main concerns in the archaeological study of the emergence of complex social organization (Blitz 2010; Carneiro 1998; Clark and Blake 1994; Drennan and Peterson 2008; Earle 1997; Johnson and Earle 2000; Spencer 1998). One of the consequences of the emergence of regional leadership is that people are attracted toward a center. This phenomenon is manifested in the archaeological record as clusters of sites gravitating around large central places. Drennan and Peterson (2012) has defined these clusters of sites as supra-local communities which result from the process of the political integration of the small communities in a region.

Based on these assumptions, Drennan and Peterson (2008, 2012) have proposed an approach to delineate supra-local communities based on the use of mathematically smoothed density surfaces to identify clustering at a regional scale (Drennan and Peterson 2012; Drennan *et al.* 2015; Peterson and Drennan 2005). In the case of the Catanga Region, I used an inverse distance-power of 0.25 to produce each surface.

During the Early times in the study area, it was possible to observe several small farmsteads clearly drawn toward the small village of Catanga. In this period, the extent of the supra-local community was approximately 105 km^2 which increased in the next two periods (Figure 3.6).

The locational stability of the settlements is one of the characteristics of the population distribution in the study area. During Middle and Late Catanga, Catanga continued to grow and

remained as a single local community much larger than any other in the region, although some small farmsteads such as El Arenal, El Pensil and Corinto, continued to grow and became small villages. These smaller communities appear drawn toward Catanga by some sort of centripetal forces making it possible to identify this as a cluster that excludes the population of Santa Juana but includes most of the territory.

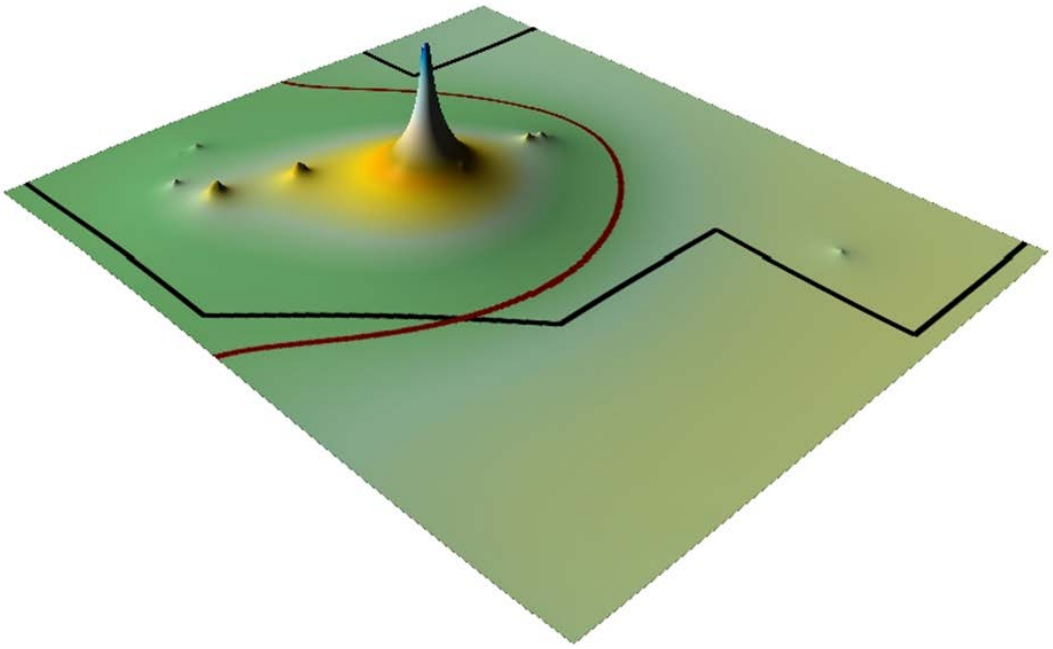

Figure 3.6 Smoothed density surface. Early Catanga Period. Inverse Power = 0.25.

The Middle and Late Catanga surfaces indicate that the smaller villages were growing more rapidly than Catanga (Figure 3.7 and 3.8). The Early Catanga local community of Catanga exceeds by quite a lot the smaller local communities, and by less in Middle Catanga and even less in Late Catanga. This trend could be related with an increase in the attraction exerted by the local chiefs in those smaller communities.

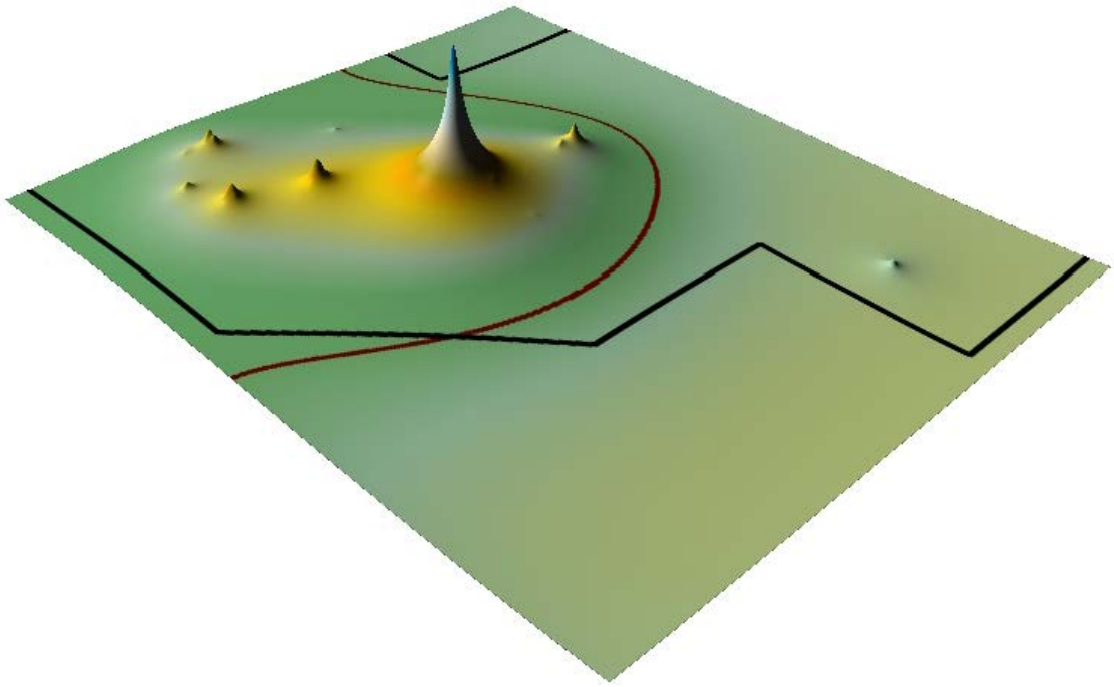

Figure 3.7 Smoothed density surface. Middle Catanga Period. Inverse Power = 0.25.

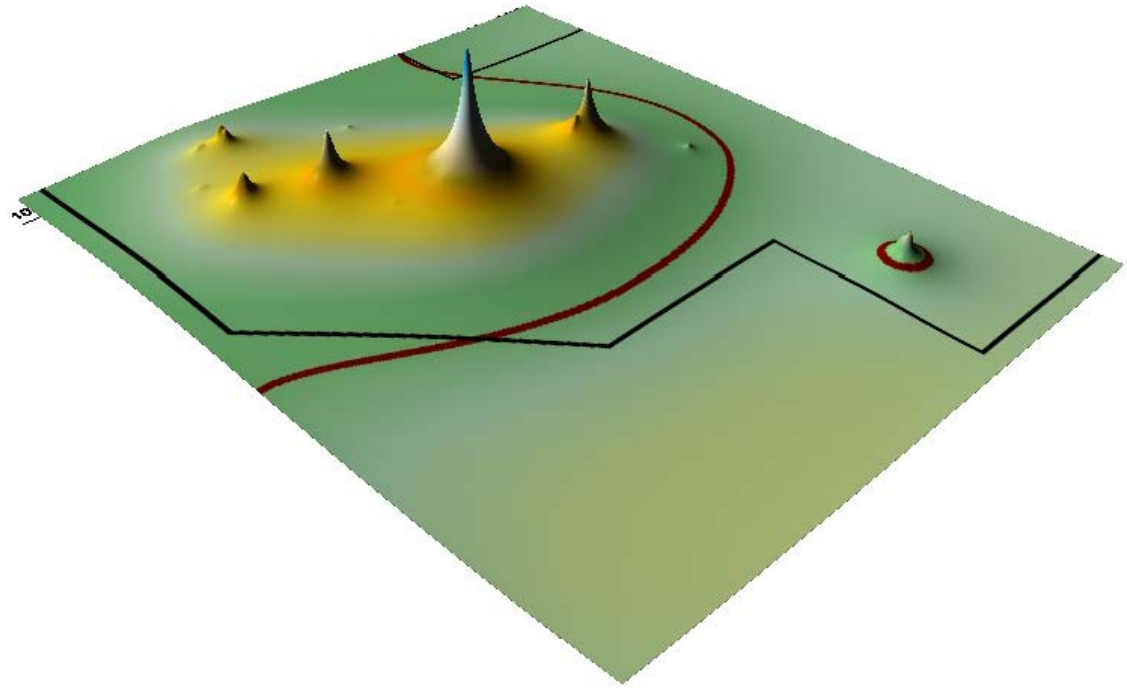

Figure 3.8 Smoothed density surface. Late Catanga Period. Inverse Power = 0.25.

The next step in the analysis of settlement patterns was to measure demographic centralization following the methodology of ring-graphs with *B* coefficient proposed by Drennan and Peterson (2008). Ring-graphs with *B* coefficient allow characterizing the strength of demographic concentration in a defined territory and comparing the differences between archaeological cases (Drennan *et al.* 2015: 76). The value of the *B* index varies between 0 and 1, with 1 being the maximum value of centralization.

The supra local communities in the Catanga region exhibited regional-scale demographic centralization, however, the centralization values changed moderately through time. During the Early period, there was a tendency of population to be concentrated around a center, in consequence, demographic centralization was strong (*B* index = 0.83). This value represents the distribution of small settlements in the region around the local community of Catanga, the largest site at that time. This pattern likely corresponds to a few families distributed across the landscape which were located from the beginning on large bancos. It seems that most of those families were concentrated in Catanga, probably they were the first inhabitants of the region (Figures 3.9 and 3.10).

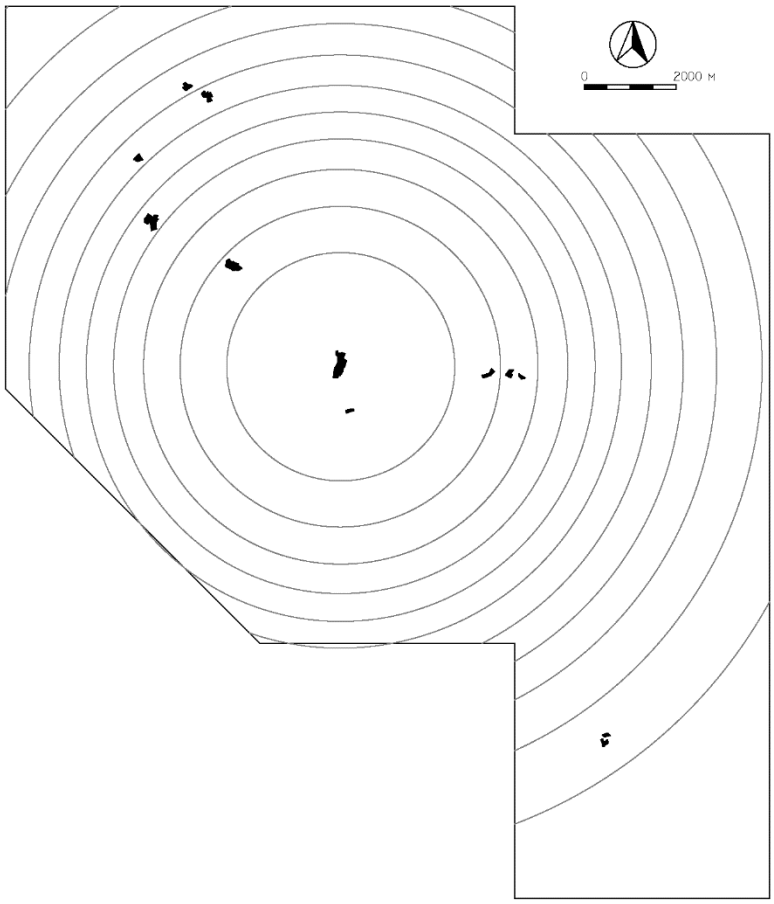

Figure 3.9 Centralization graph. Early Catanga Period.

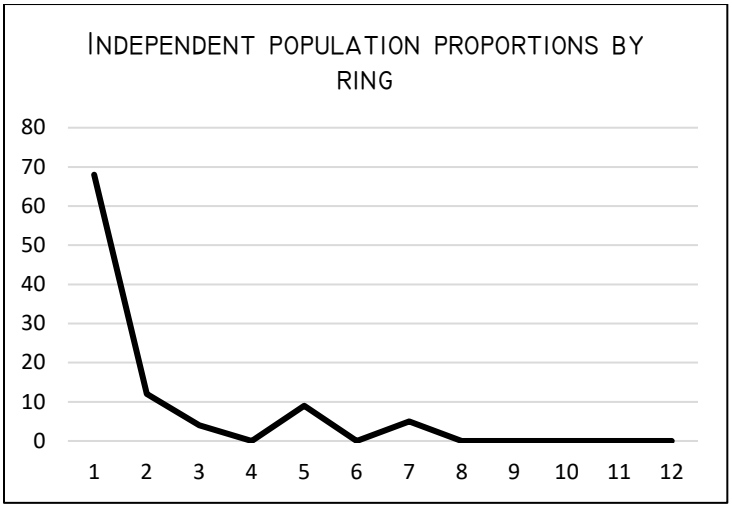

Figure 3.10 Centralization analysis for Early Catanga period.

During the Middle Catanga period, the regional population appears less concentrated around Catanga and other local communities also tend to concentrate more people such as El Arenal, Corinto and El Pensil. This decrease in the strength of centralization is demonstrated by the *B* index value of 0.73. However, this value still continues to be high, which indicates that during Middle Catanga period people tended to be pulled toward the site of Catanga as during early times. (Figures 3.11 and 3.12).

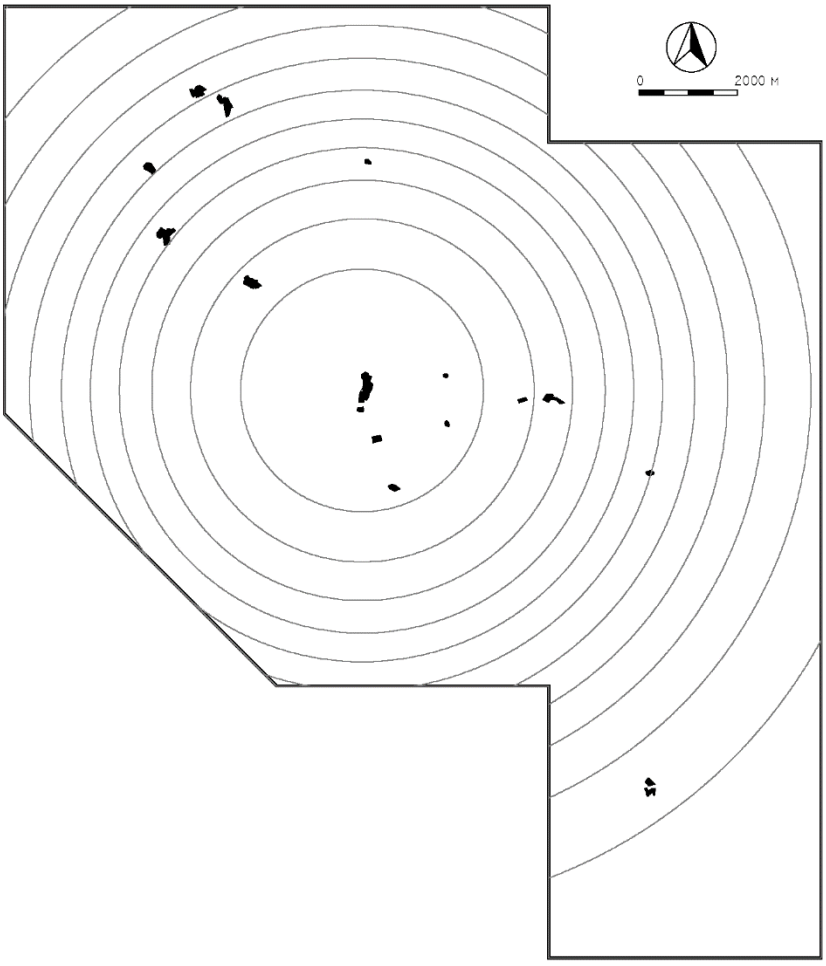

Figure 3.11 Centralization graph. Middle Catanga Period.

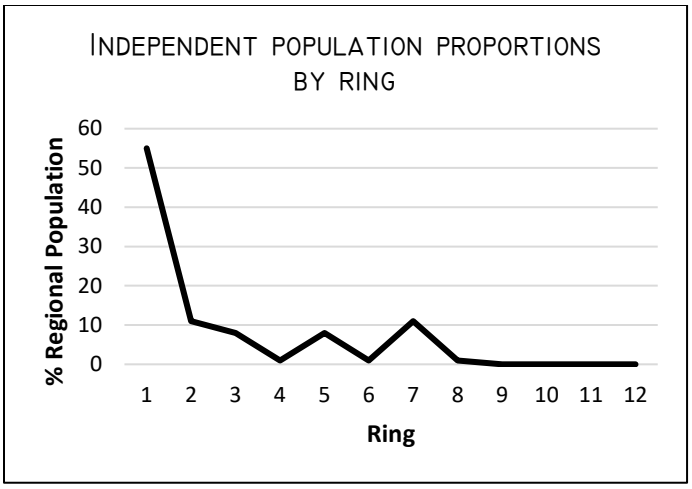

Figure 3.12 Centralization analysis for Middle Catanga period.

The regional attraction exerted by the local community of Catanga continues during the Late period; however, its intensity diminishes. During this period, most of the population was concentrated in the innermost ring and the next two inner rings exhibit important increments in the proportions of regional population compared to the previous periods. The effect of this new population distribution is that the strength of centralization continues decreasing as is shown by the *B* index (0.68), nonetheless this value is still high (Figures 3.13 and 3.14).

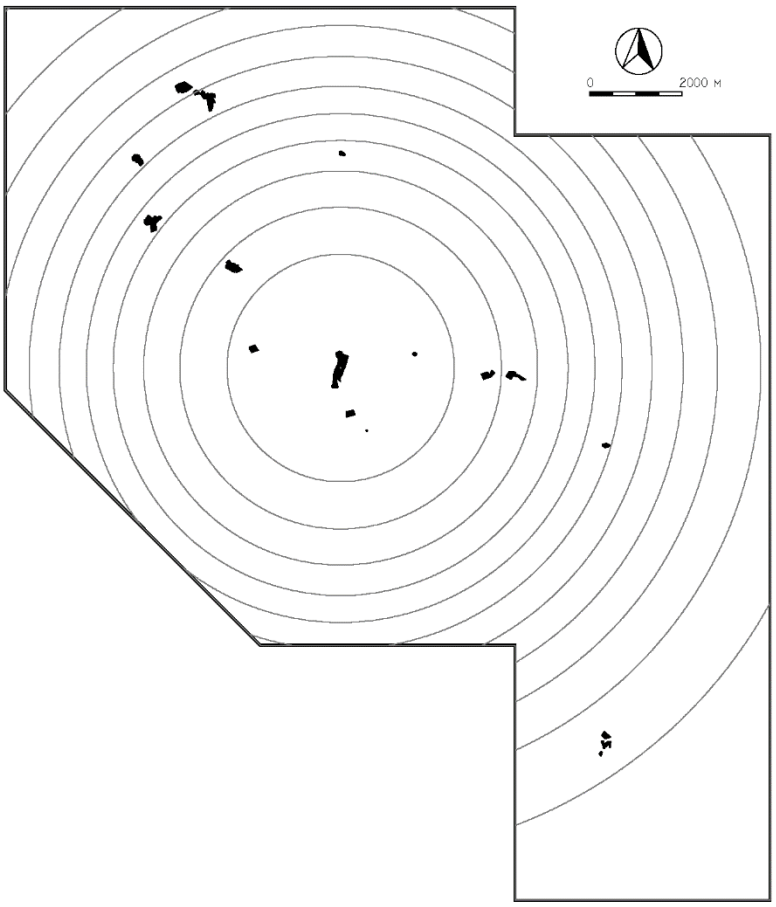

Figure 3.13 Centralization graph. Late Catanga Period.

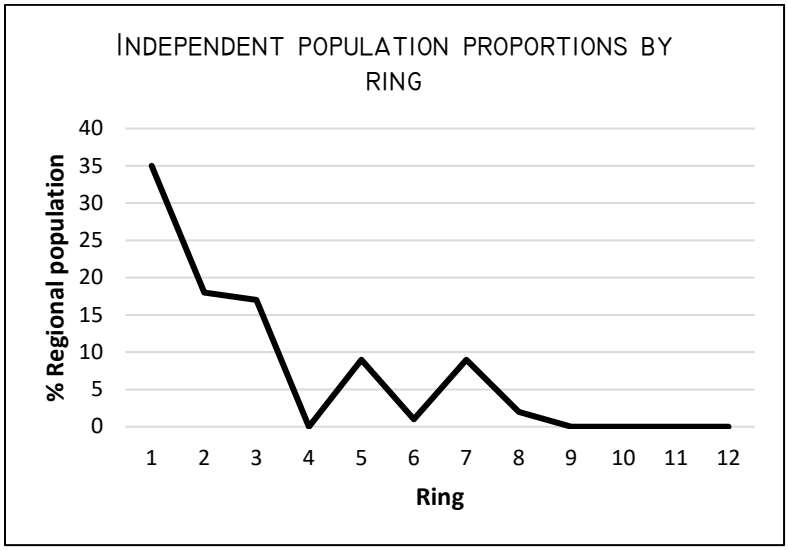

Figure 3.14 Centralization analysis for Late Catanga period.

Mound construction has been related with centralization in the Llanos of Barinas (Gassón 1997, 1998; Redmond *et al.* 1999; Spencer 1998). In the study area, there is no monumental mound architecture like that erected in Barinas. Yet, small mounds were constructed in Catanga and some of the smaller villages such as El Arenal and Corinto (Figure 3.15).

It is very likely that in sites such as El Pensil and Tilodirán mounds also were build; though, modern farming in those sites could have destroyed them. These mounds were small in size, around 20-25 in diameter and 0.5 m – 1 m high, and flat on top. The archaeological evidence suggests that they were used as elite residences. The mounds were located in the central areas of the villages. Around these mounds, utilitarian and decorated ceramics, lithics made of imported raw materials, large concentrations of burned faunal bones and charcoal were recorded. In the case of Catanga, a metal earing was unearthed. El Arenal is the only site in which two mounds were erected. (Figure 3.16)

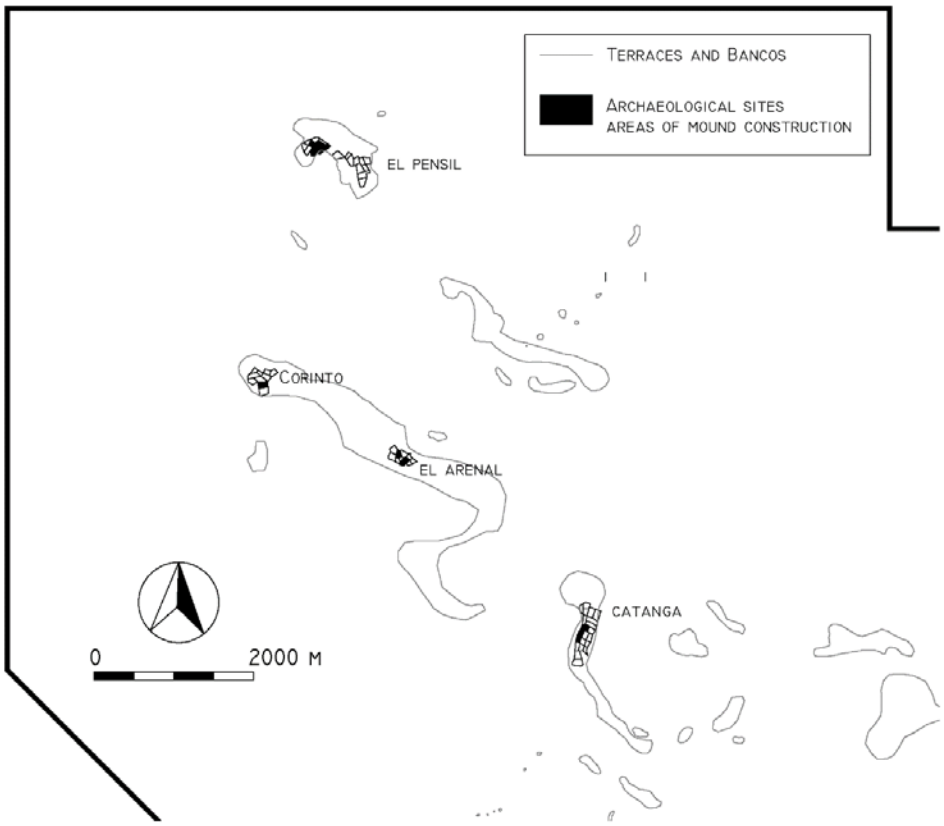

Figure 3.15 Mounded areas in some of the archaeological sites in the study area.

Figure 3.16 Artificial Mound. El Arenal Archaeological site. Height (H) = 68 cm.

The mounded structures were constructed as accumulations of earth that probably was carried from nearby. This task could be performed by a family or a small group of workers and did not require much mobilization of labor compared with the construction of mounds in Barinas. Spencer and Redmond (2008, 2014) and Gassón (1998) have described similar structures in the primary centers of El Gaván and El Cedral, they also have argued that these small mounds represent residential areas.

The archaeological evidence suggests that these structures were residential in function although the available information does not provide a solid clue about when they were constructed. The stratigraphic tests conducted close to the mounded structures in Catanga and El Arenal provided ceramics from the three chronological periods. It will be important to conduct excavations to establish if those structures were constructed during Early times when the population density was low, or if they were erected later when the local communities had reached larger demographic scale. If they were erected early, it is probable that this was a representation of the founders' authority and prestige. If they were constructed during the Middle or the Late period, it is likely that they were related with leadership competition in which emerging chiefs tried to establish differences between themselves and their followers constructing these structures to reside above them.

Although in El Pensil there were 11 mounds of 2-4 m of diameter and 1 m - 1.50 m high, their small diameter and their location on flooding terraces suggest that were used for farming and not for living (Figure 3.17). This kind of small mound has been associated with agricultural activities in other areas of the Llanos (Reichel-Dolmatoff and Dussán 1974).

In the construction of these small mounded structures little resources and labor were invested. Their modest scale suggests that they could be erected with the labor of just a couple of people.

In sum, the settlement pattern analyses carried out in the study area have demonstrated the existence of a regional polity from the beginning of the occupation. Around 1000 A.D. this polity was composed of a small number of families distributed on farmsteads gravitating around the small village of Catanga in a territory of approximately a hundred square kilometers. During the Middle Catanga period the supra-local community expanded its territory slightly but doubled its population. Some of the small farmsteads became small villages and the local community of Catanga continued to be the focus toward which these smaller villages were drawn. In the Late Catanga period, the population was tripled but the territory slightly expanded. Although the dense nucleated village of Catanga was still the center of a large cluster of large and small settlements, the smaller villages also experienced significant increases in their associated population. The accelerated demographic growth of some villages such as El Arenal, Corinto, and Tilodirán caused a redistribution of the regional population producing a decrease in the strength of regional centralization although population was still attracted toward the Catanga regional center.

Figure 3.17 Mounded structure probably used for farming. El Pensil, archaeological site.

4.0 AGRICULTURE AND THE EMERGENCE OF COMPLEX SOCIETIES FROM THE LLANOS OF CASANARE

The regional analysis of the distribution of population and the distribution of agricultural resources (land use) is one of the most frequent methods used to evaluate the relevance of agricultural production in terms of the emergence of leadership. The evaluation of how strong was the correlation between these two variables is useful to understand the extent to which political leaders are involved in organizing agricultural production or the extent to which elites of some kind control prime agricultural resources and owe their positions in part to that control (Nicholas 1989).

4.1 SOIL PRODUCTIVITY AND POPULATION DISTRIBUTION

To evaluate how strong was the correlation among the distribution of good farming soils and the distribution of population in the study area different methodologies were used. The first step was to evaluate the correspondence of these two variables. To do that, three types of soils were defined according to their productivity (Figure 4.1).

In this analysis, because of the marked differences in the total area of each type of soil, it was expected that the larger zones have more population associated with it (Drennan *et al.* 2015: 88). The settlement density for each type of soil was calculated. Spearman's rank correlation was used to measure the strength and the significance of the relationship between population density and soil productivity for each of the three periods defined.

During the Early Catanga period, the rank order correlation is positive but with low statistical significance (r_s= 0.50, p = 0.67, n=3). Agricultural productivity might well have been an important consideration in deciding where to live, but the sample of different soil categories is too small to yield much confidence in such a conclusion (Table 4.1). In the El Cedral region, for example, people chose to settle a long banco area with poor soils while leaving free patches with better soils (Vargas 2012).

During Middle and Late Catanga times, the rank order correlation is strong and positive (r_s= 1, p = 0.00, n=3); however, since the correlation is 1 (the correlation is perfect), the associated significance value may be misleading. The sample of separate and independent observations is, after all, just the 3 zones of soils that have been defined (Tables 4.2 and 4.3).

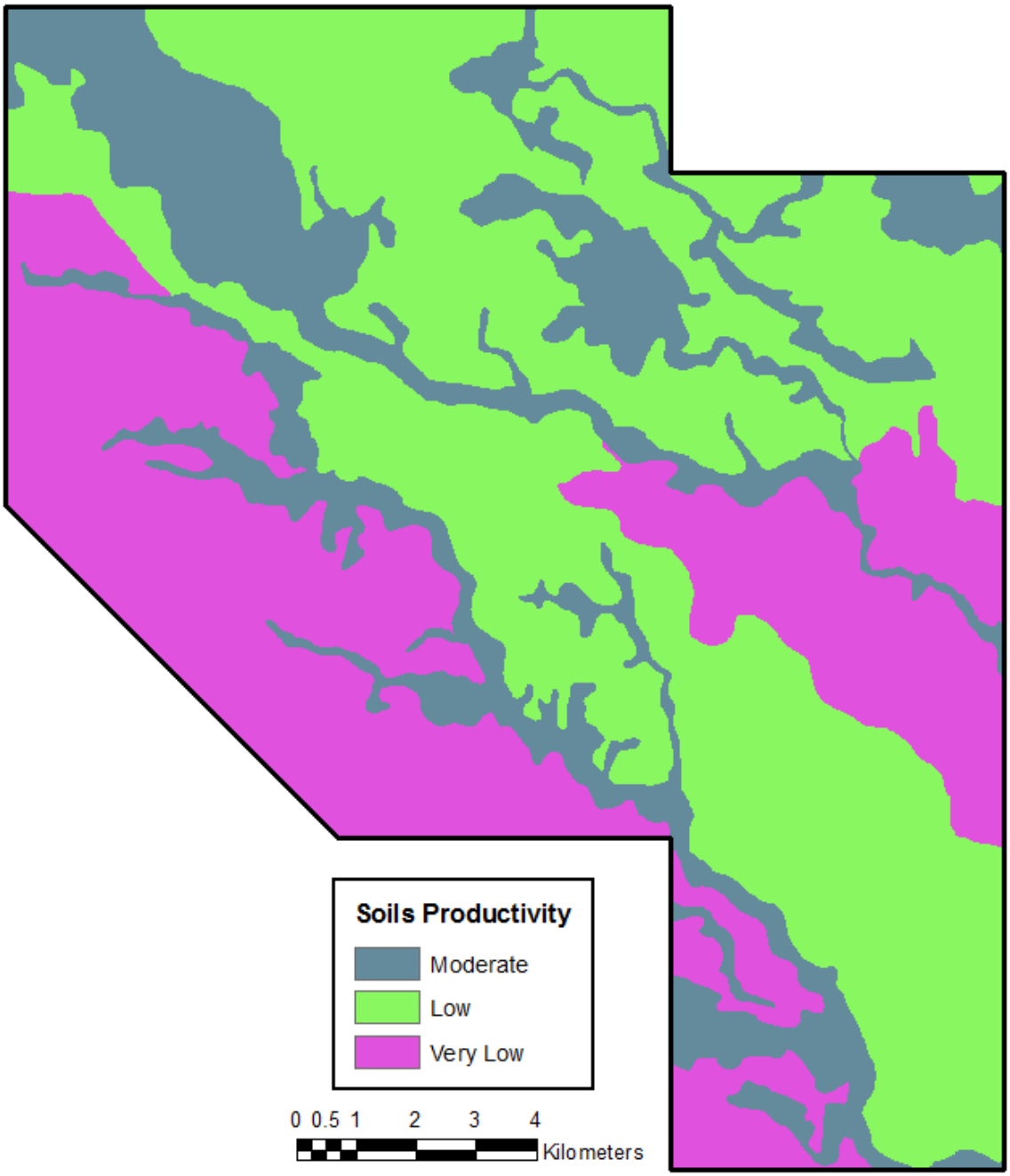

Figure 4.1 Soils fertility across the Study Area.

Table 4.1 Early Catanga period Occupation in three soils Zones.

	Rank Productivity	Hectares	Settlement Area (ha)	Settlement Density
Moderate	3	5255.96	7.83	0.0015
Low	2	10474.52	19.69	0.0019
Very Low	1	7279.91	4.49	0.0006

Table 4.2 Middle Catanga period Occupation in three soils Zones.

	Rank Productivity	Hectares	Settlement Area (ha)	Settlement Density
Moderate	3	5255.96	18.08	0.0034
Low	2	10474.52	25.47	0.0024
Very Low	1	7279.91	5.16	0.0007

Table 4.3 Late Catanga period Occupation in three soils Zones.

	Rank Productivity	Hectares	Settlement Area (ha)	Settlement Density
Moderate	3	5255.96	20.07	0.0038
Low	2	10474.52	28	0.0027
Very Low	1	7279.91	7.29	0.0010

Because the results of the rank correlation analysis did not provide solid results, I decided to use an alternative approach based on the definition of catchment areas. The approach consisted of the delineation of squares 4 km by 4 km, following the methodology proposed by Nicholas (1989) for the Valley of Oaxaca to observe if the squares with the highest fertility indexes were the most densely occupied. A total of 20 squares were delineated (Figure 4.2). The population density was calculated for each one. Spearman's rank correlation between soil productivity and population density was calculated for each period.

To generate the productivity index, the amount of each type of soil was measured in each square and a fertility score was defined to each one: soils with "very low" fertility had a productive value of zero; "low" fertility land had a productive value of 1; and "moderate" productivity soils had a productive value two times that of "low" for a value of 2. Then, I multiplied the square kilometers of "very low" land by 0, of "low" land by 1, and of "moderate" land by 2, and summed up the three numbers to obtain a fertility index (Robert Drennan, personal communication 2017). This is not a precise measure of productivity but rather a guess that moderate productivity soils could produce about twice as much as low productivity soils.

Since so many squares are incomplete and thus small, both the fertility index and the estimated population for each period were divided by the size of the respective square (Table 4.4).

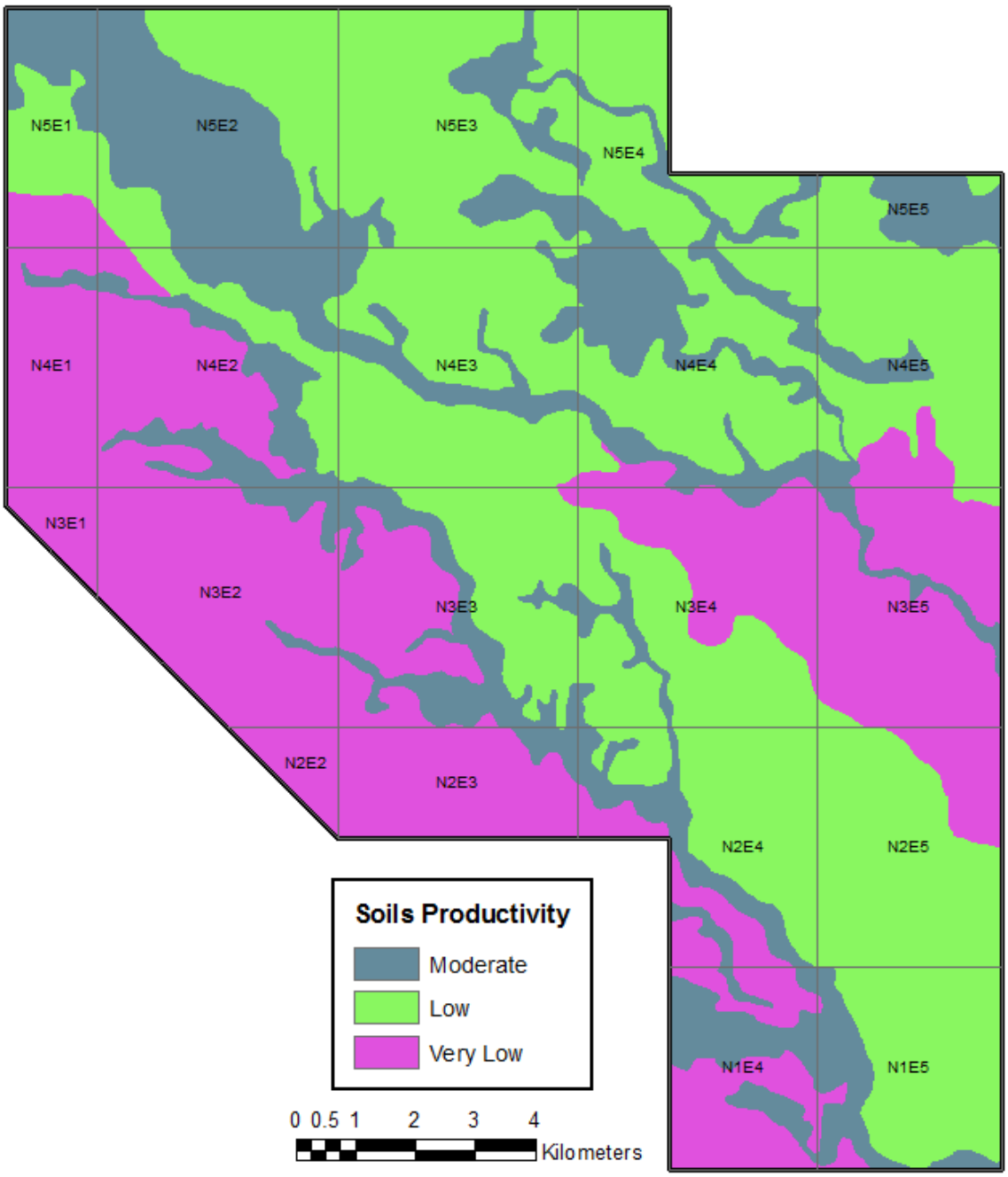

Figure 4.2 Soils fertility - 4 km by 4 km squares.

Table 4.4 Fertility index and population density. 4 km by 4 km squares.

GRID	Hectares by productivity				Fertility Scores			Fertility Index/ km2	Estimated Population			Early Catanga Population Density persons/ km²	Middle Catanga Population Density persons/ km2	Late Catanga Population Density persons/ km2
	Very low	Low	Moderate	Total (ha)	Score Very low (0)	Score Low (1)	Score Moderate (2)		Early Catanga	Middle Catanga	Late Catanga			
N3E4	657.0	812.4	130.6	1600.0	0.0	812.4	261.3	0.7	0.0	1.0	5.0	0.0	0.3	0.6
N3E3	558.8	616.3	424.9	1600.0	0.0	616.3	849.9	0.9	0.0	2.0	0.0	0.0	0.0	0.0
N4E4	63.1	894.7	642.3	1600.0	0.0	894.7	1284.5	1.4	6.0	17.0	101.0	0.4	6.3	11.3
N4E3	3.4	1311.1	285.4	1600.0	0.0	1311.1	570.9	1.2	32.0	82.0	292.0	2.0	18.3	22.3
N4E2	739.4	253.5	607.1	1600.0	0.0	253.5	1214.1	0.9	30.0	44.0	162.0	1.9	10.1	63.9
N5E3	0.0	1260.7	339.3	1600.0	0.0	1260.7	678.6	1.2	0.0	2.0	4.0	0.0	0.3	0.3
N5E2	15.1	677.7	907.3	1600.0	0.0	677.7	1814.5	1.6	10.0	39.0	81.0	0.6	5.1	12.0
N5E1	131.9	258.4	219.8	610.0	0.0	258.4	439.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0
N5E4	0.0	724.1	202.2	926.3	0.0	724.1	404.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0
N5E5	0.0	155.9	231.6	387.5	0.0	155.9	463.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0
N4E1	580.9	0.0	29.1	610.0	0.0	0.0	58.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
N4E5	138.4	965.1	136.4	1239.9	0.0	965.1	272.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0
N3E1	160.1	0.0	0.0	160.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N3E2	1271.1	0.0	89.6	1360.8	0.0	0.0	179.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
N3E5	1100.4	40.2	99.4	1240.0	0.0	40.2	198.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0
N2E2	164.3	0.0	0.0	164.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N2E3	676.9	0.5	52.4	729.9	0.0	0.5	104.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0
N2E4	240.6	733.0	289.3	1262.9	0.0	733.0	578.5	1.0	6.0	14.0	82.0	0.5	6.5	11.2
N2E5	220.9	1018.8	0.3	1240.0	0.0	1018.8	0.6	0.8	0.0	0.0	0.0	0.0	0.0	0.0
N1E4	503.1	0.0	323.8	826.9	0.0	0.0	647.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0
N1E5	44.4	754.3	247.6	1046.3	0.0	754.3	495.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0

During the Catanga Early period, the correlation between the archaeological estimated population and the grid productivity was positive but weak and of little significance (r_s= 0.28, p = 0.25, n=21) (Figure 4.3).

The value of the correlation during the Middle Catanga period remained weak and of little significance (r_s = 0.33, p = 0.15, n=21) (Figure 4.4). This result is expected because the largest villages were in the same locations as in the early period.

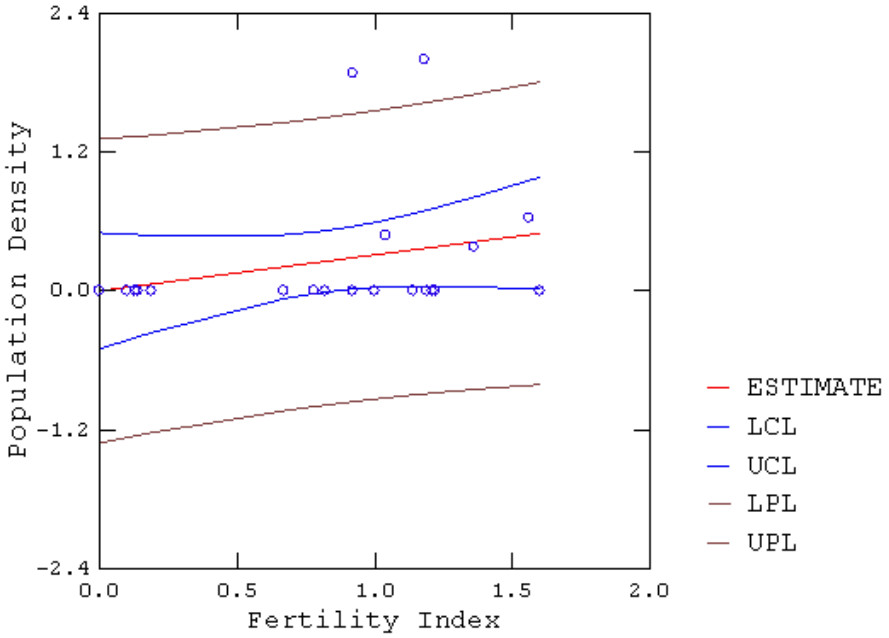

Figure 4.3 Scatter plot of estimated population by soil fertility in 4 km by 4 km squares. Early Catanga Period.

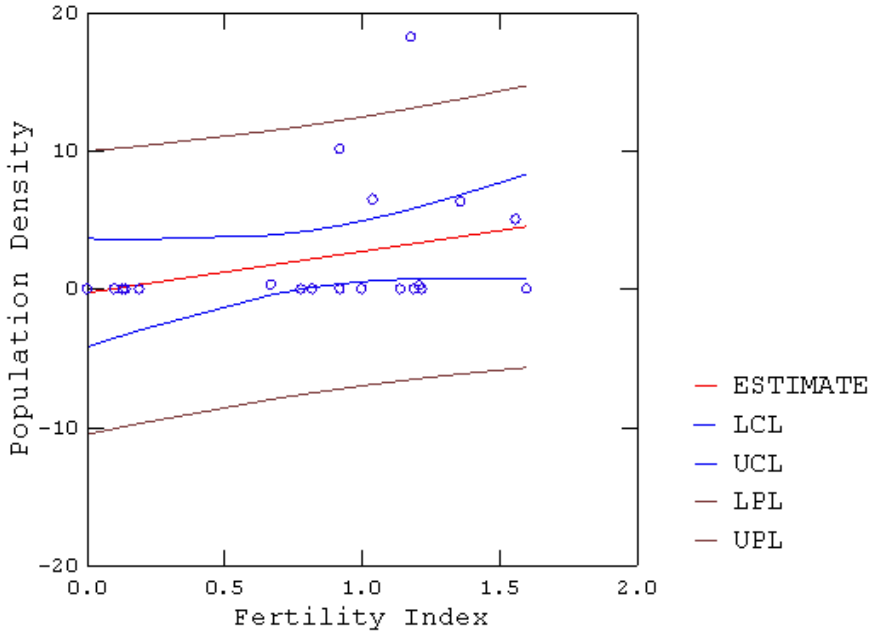

Figure 4.4 Scatter plot of estimated population by soil fertility in 4 km by 4 km squares. Middle Catanga Period.

For the next period, Late Catanga, the correlation is still very weak and of little significance (r_s = 0.21, p = 0.35, n=21). Although the population increased by three times that of the previous period, it still remained settled in the same locations.

These results suggest a population tendency to live near better soils for farming. It is important to elucidate that the analysis 4x4 km squares is not about the soils people lived on, but the soils they lived nearby, but that tendency through time is fairly weak and of little statistical significance. The values of the correlations may just mean that the number of people in the region was small and that there was plenty of empty territory so they could just settle about anywhere and have a good amount of reasonably productive soils near at hand.

4.2 AGRICULTURAL INTENSIFICATION

Large zones covered by raised fields were recorded during the pedestrian survey in the study region. Several of these zones of farming earthworks were delineated in aerial photography during the preliminary reconnaissance. The raised fields in the study region are similar to those of Barinas and cover an extension of 510 hectares, approximately. To implement this technology, the indigenous population took advantage of the natural relief composed of bancos and bajíos to transform these landscape units into raised field areas. The technique was based on the expansion of narrow banks by piling up soils from digging and deepening the adjacent bajío areas. In other instances, broad areas of bancos were divided into independent fields by digging divisions in the banco structure. These divisions were used to redirect the water flow during the

flooding season. It is likely that this farming technique had started to be used at some point between the Middle Catanga and the Late Catanga times, based on the direct association of one of the larger areas of raised fields with Middle and Late Catanga ceramic materials at the site of El Medano.

The population projections suggest that there was no imbalance between population and agricultural resources but further indicate that there were very low population densities; hence, it is very likely that the implementation of raised field agriculture was related to social consumption just as Gassón (1998) has proposed to the El Cedral region. As I will discuss later, during the transition between the Middle and the Late Catanga period, ceremonialism likely increased as a result of leadership competition. In such a scenario, it is plausible to consider that raised fields agriculture was to intensify surplus production that could be redirected by the emerging elite to finance their strategies.

An alternative scenario is that these raised fields were implemented in areas of low productivity in order to increase it. To test this hypothesis, I conducted an analysis of the correlation between soil productivity and the distribution of raised fields based on the 4 km by 4 km squares.

The Spearman's rank correlation indicates a weak correlation of little significance between the most productive squares and the raised fields zones ($r_s = 0.18$, $p = 0.45$, $n=21$). This positive value could suggest that although people consider good soil important there were also other factors affecting the raised field distribution. Figure 4.5 shows that raised field complexes

were relatively small and scattered, and they occurred in substantial amounts on all three kinds of soils, which is consistent with the very low correlation coefficient.

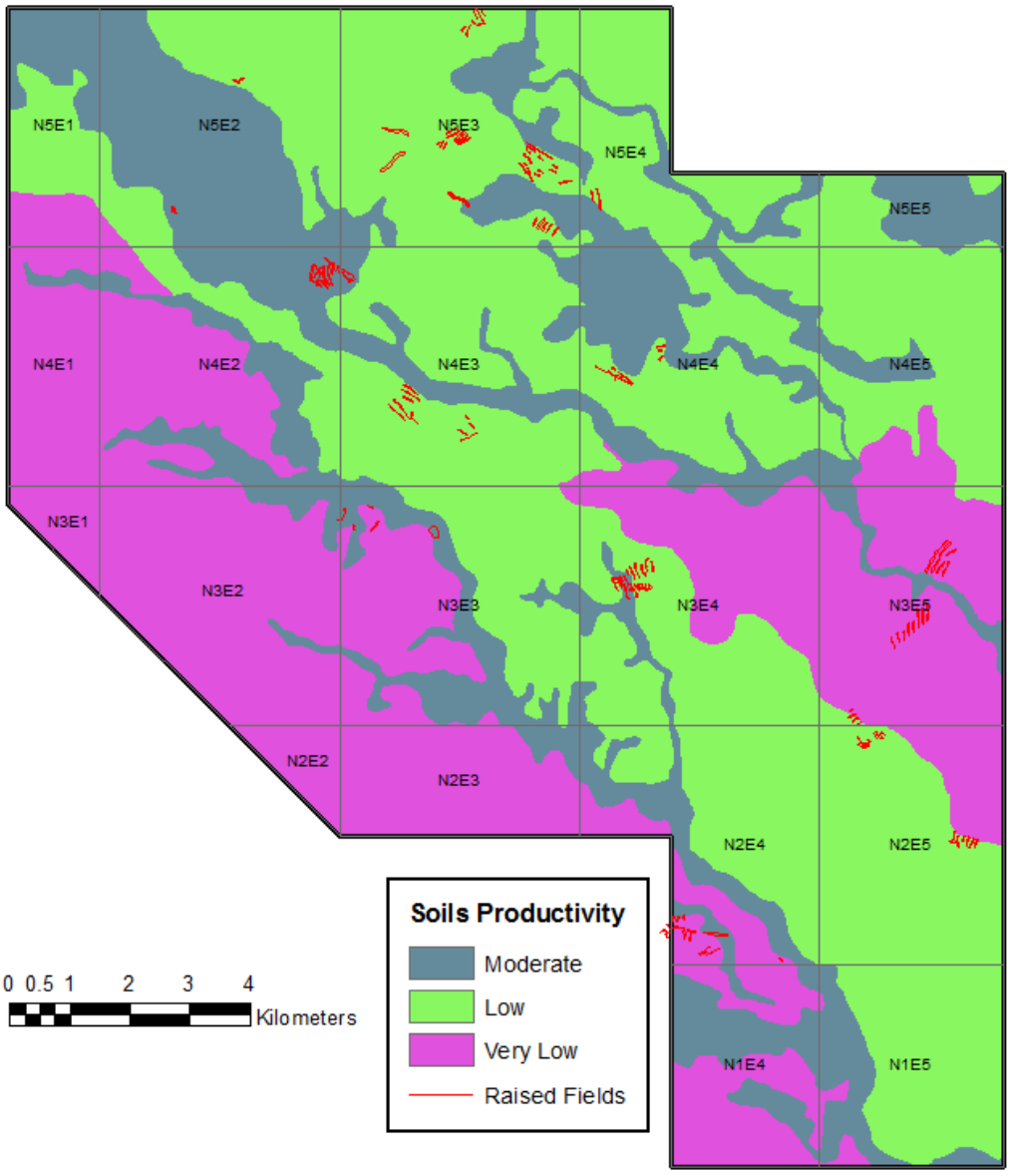

Figure 4.5 Raised fields distribution and soils fertility potential in the Study Area.

In the Llanos, there are other variables that can affect the decision of where to locate farming areas, and flooding is one of them. The excess of water is negative for farming, so it is expected that people avoid poorly drained soils. Based on pedological characterization (IGAC 2014) which included the drainage conditions for each soil type present in the study area, soils were reclassified into two zones (Figure 4.6): those with good drainage and those with deficient drainage. Well drained soils represent 26% of the study area and soils with deficient drainage represent 74 %. Raised fields were concentrated in a slightly larger proportion in soils with deficient drainage (Table 4.5). This distribution suggests that drainage was a factor of moderate importance to choose where to locate the raised fields facilities.

Table 4.5 Distribution of Raised fields according to drainage conditions of the soils.

Drainage conditions	ha	Raised Fields (ha)	% area covered by raised fields
Good	6151.06	107	1.74
Deficient	16853.8	403	2.39

However, these results do not explain why people construct raised fields in areas with good drainage. A likely explanation is that the available characterization does not reflect small scale variation in drainage conditions and as a consequence it does not correspond to the real conditions. Thus, it is likely that these zones are misclassified and those raised field complexes are actually in zones of poor drainage. There is also the possibility that although the soils have good drainage conditions, the amount of water that they need to drain during the rainy season exceeds their capacity. Seasonal rains in the study area are recognized to be intense and most of

the region remains flooded during the highest peaks of precipitation. Raised field construction could be a good strategy to protect winter crops from water excess.

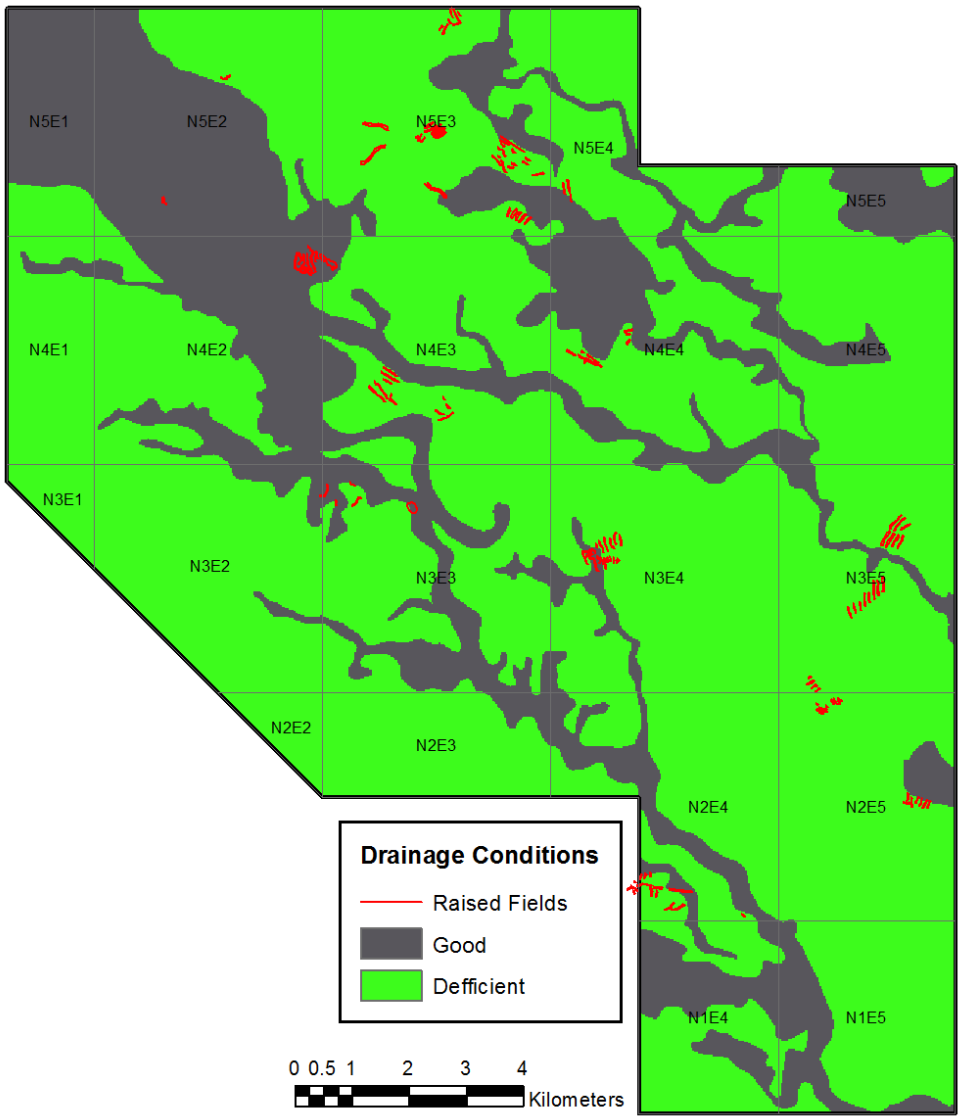

Figure 4.6 Distribution of soils according to drainage conditions.

Answering why people choose to cultivate raised fields could be related to the agricultural pathway that Catanga societies followed. Zucchi and Denevan (1979) have considered swidden agriculture as a practice that precedes ridged field cultivation In the Llanos.

The ethnographic descriptions of Bari swidden agriculture from Maracaibo Lake in Venezuela indicate that this farming technique is composed by of several labor phases which require continual and high energy investments especially during the clearing and burning stages; however, the returns are low and prevent the production of large amounts of surpluses (Beckerman 1987, 64). Although swidden agriculture could be carried out by small parties of farmers, its yields remain low. This is a problem in a context in which individuals and families are competing for prestige and recognition.

Swidden agriculture in the Orinoco and the Amazonas is practiced by groups of very low density, less than 1 person/km^2. The population estimates for the Catanga region suggest a demographic transition between the Middle and the Late Catanga periods in which population density increased from 2 persons/km^2 to 6 persons/km^2. Although these densities are still very low and suggest no imbalance between population and resources, the intensification of swidden agriculture might not have been the most profitable option for prehispanic rulers. Although they could have cultivated more land because it was abundantly available, the labor investment might not have been compensated by the returns. In such a scenario, it is likely that the prehispanic inhabitants developed a more productive alternative such as raised field cultivation. This decision was probably related to the necessity to produce more agricultural surpluses in a social context

in which social competition through ceremonialism was increasing as Gassón (1998) has proposed for the El Cedral region and as I will discuss later for the Catanga region.

Ethnography also suggests a decline in the productivity of fields through time for swidden agriculture. After 3 or 4 years of continuous use, productivity declines and the Bari abandoned unproductive fields which were replaced by new ones (Beckerman 1987, 64). The ethnographic data I collected in El Cedral region suggests that raised fields can be cultivated continuously during 10 – 20 years. After that, their productivity decreases as a result of weeds and increase of harmful insects just as happens with swidden agriculture (Vargas 2011). From this perspective, raised fields reduce the costs of clearing and burning that are stages in swidden that require high labor investments.

In the Bari case, there are two patterns of distribution of raised fields. On one hand, there are some fields which are located close to the large settlements holding up to 100 people. On the other hand, there are fields that are located far away from the Bari villages, up to as much as 7 km, which is the distance people are willing to walk to a plot (Beckerman 1987: 64). The agricultural landscape of the Bari region is thus composed of patches of fields, some of them located close to the large settlements, and others located far from the settlements and far from each other. The explanation for this distribution is that, as a part of the native agroecological management, fields require tall forest to control the growth of weeds and as a source of nutrients to enrich the soils. These agroecological conditions produce a fragmented distribution of raised field complexes across the regional landscape in continuous modification in which new fields are created and old ones grow back to tall forest. This description corresponds well with what has

been observed in Catanga, where the farming complexes look dispersed and fragmented. It is likely that although swidden and raised field agriculture are different farming technics, both were affected by the same ecological conditions in prehispanic times. I have reported elsewhere (Vargas 2011) that weeds and harmful insects affected raised fields in El Cedral and that the contemporary farmers deal with this problem by stopping cultivation and abandoning the raised fields that became less productive and that require increasing labor effort to keep them under production. Thus, it is very likely that in order to control insects or increase soil fertility by fallowing, the distribution of raised fields in the Catanga region was patchy.

In sum, it appears that no single factor can explain by itself why people in the Llanos chose to practice raised field agriculture. Although there were some ecological factors such as soil productivity, drainage conditions and decrease in fertility that could be related with this decision, these are not alone sufficient to answer this question. When alternative farming practices are considered, the evaluation of labor investment and obtained returns is an important factor. The ethnographic information suggests that raised field agriculture was a more productive technique than swidden. Raised field agriculture could be a suitable agricultural strategy to ensure that the agricultural output per unit of land went up although the agricultural output per unit of labor went down. Therefore, raised fields provide the opportunity for some individuals from the local communities to produce and mobilize agricultural surpluses.

4.3 EVALUATING THE POTENTIAL TO PRODUCE AGRICULTURAL SURPLUSES

Although so far, I have presented a theoretical discussion of the models that consider the production and appropriation of agricultural surpluses as fundamental to the political process of leadership emergence, there has not been an evaluation of this argument. This section presents an analysis of the capacity of the Catanga polity to produce agricultural surpluses.

In the case of the Llanos of the Orinoco, raised field facilities have been associated with intensive agricultural production (Gassón 1998; Spencer 1993, 1994, 1998; Spencer *et al.* 1994; Zucchi and Denevan 1979; Vargas 2012). At least three different analyses have been carried out in the Llanos of Barinas to evaluate agricultural productivity (Gassón 1998; Spencer *et al.* 1994; Vargas 2011). Prehispanic inhabitants modified the natural landscape while maintaining the banco-bajío structure, which was optimal to the reproduction of plants and animals in the savanna units. The analyses conducted by Spencer *et al.* (1994) and Gassón (1998) were aimed at evaluating whether during prehispanic times there was an imbalance between population and productivity, or in other words, whether population pressure was present. These researchers arrived at the conclusion that the regional populations of El Cedral and El Gaván polities did not exceed the agricultural capacity of their regions. On the contrary, in both regions the potential population that can be supported by raised field agriculture was much larger than the archeologically estimated population. The projections of agricultural productivity suggest that the complex societies of the Llanos of Barinas were capable of producing enough agricultural surpluses based on raised field agriculture. The agricultural resources generated through this technique were used during bad years in which alternative practices failed to provide food for

local populations. During good years in which swidden, small garden and levee cultivation were successful, the raised field production generated surpluses that could be directed toward elite political activities such as warfare, feasting, long-distance exchange and creation of monumental architecture, all activities that could enhance the elites' own status, wealth, power, and/or authority (Gassón 1998; Spencer 1993, 1994).

Gassón (1998) and Vargas (2011) have tried to visualize the amount of agricultural surpluses produced in their respective study areas, based on the delineation of catchment areas, the delineation of landscape units and the assignment of agricultural yields and agricultural potential of every landscape unit. The projections made by Spencer *et al.* (1994), Gassón (1998) and Vargas (2011) were based exclusively on maize production and consumption, which is problematic because as Spencer *et al.* (1994: 134) has pointed out "this simplifying assumption admittedly introduces an element of error into the analysis. To the extent that farmland was planted in crops other than maize, the exercise will overestimate maize production and hence potential population". The second source of error that could introduce an overestimation of the agricultural productivity comes from the amount of land under cultivation in each catchment. Both Gassón (1998) and Vargas (2011) included the total area of the catchment. Based on the delineation of landscape units, they propose a different rate of production for each of them. These previous projections of agricultural productivity have included the total area of the catchment as if it were completely farmed. However, as I have discussed before, the agroecological conditions in the area impose some constraints such as the need for dispersal of raised fields separated by forest areas to increase their productivity and limit the impact of weeds

and insects. When the whole territory is considered as cultivated, it overestimates agricultural production.

Dickson (1980) proposed linear programming as a method for simulating the agricultural carrying capacity of the Maya site of Tikal, Guatemala. His goal was to calculate what combination of crop resources, land utilization, labor output, and agricultural strategy would support a maximum human population at that site. To apply the method of linear programming all variables must to be quantifiable and comparable to one another in numerical terms.

I have adapted Dickson's proposal to evaluate the production of surpluses in the Catanga region. The production and consumption estimates on which the following projections were based correspond to ethnographic information collected by Clark and Uhl (1987) in the Upper Rio Negro (Venezuela), and from El Cedral region in Barinas collected directly by me during the 2008 – 2010 field seasons (Vargas 2011). Clark and Uhl (1987) have presented detailed information about cassava (*Manihot esculenta Crantz*) and I have recorded data about Maize (*Zea mays*).

My intention is not to predict the exact amount of surpluses produced in the region but to demonstrate the capability of the Catanga population to produce them within the most plausible range of possibilities. For instance, I decided to include cassava and corn in my projections based on the fact that both cultivars were reported by chroniclers and their presence in the palynological record in Barinas. In the Catanga region, a few metates and manos were found, which indicates the production and consumption of maize. In the case of Barinas, raised fields allowed production of two crops per year according to the information collected. In the

case of the region of Catanga, I based my estimates on just one crop in order to constrain the simulation of surplus production and considering a multi-cropping cycle of extended duration such as is practiced in swidden agriculture. The data also includes the costs of production and the returns of the investment measured in kilocalories for both cultivars. In addition, although the daily caloric need per person has been estimated at 2500 Kcal/day, it seems very logical that a person's diet was not based exclusively on maize and manioc but also on other plant species and fishing and hunting resources.

The first projection was based on the total population estimated for the Late Catanga period and the total area covered by raised fields (Table 4.6).

As argued before it appears that raised field construction started during the Middle Catanga period and their use continued until the Late Catanga period. The results suggest that in the Catanga region, population was not required to cultivate all the raised field areas but just a proportion of them. If raised fields in Catanga only produced maize, just 55 ha (10.80% ± 2.70 %, at 95% confidence level) were required to feed the entire population. If raised fields were harvested only with cassava just 161 ha (31.5% ± 4.0 %, at 95% confidence level) should be sown.

Table 4.6 Agricultural production in the study area. Maximum estimated population.

Variable	MAIZE	CASSAVA
Labor investment per hectare per year (Kcal)	310,588	660,000
Kcal output per hectare per year (Kcal)	6,375,000	2,720,000
Daily per capita intake per person (Kcal)	1,250	1,250
Daily Caloric needs per person (Kcal)	2,500	2,500
Yearly energy needs per person (Kcal)	456,250	456,250
Average Archaeological Estimated Population (# persons)	727	727
Yearly population energy needs (Kcal)	331,693,750	331,693,750
Ha of raised fields available to be cultivated	**510**	**510**
Ha of raised fields required to support regional population	**55**	**161**

Fallowing is other important factor to consider in the evaluation of agricultural productivity in a region. It has been pointed out by Vargas (2011) that the productivity of the soils in the Llanos decreases with time as weeds and insects increase, and for that reason, every 10 – 15 years a field needs to be abandoned and left fallow. As a result, a substantial portion of raised fields were not used at a given moment, but were left fallow. However, the projections suggest that if the total raised fields recorded on the study area were only cultivated with cassava, just 31.5% of their area was necessary to support the regional population of the Late Catanga period

allowing for substantial fallow. A combination in which maize is the larger proportion of the combination of the two staples (maize and cassava), can increase the yields of the same area.

Figure 4.7 represents the situation described above. The X-axis corresponds to the number of hectares sowed with cassava, the Y-axis corresponds to the number of hectares sowed with maize. The lower line represents the minimum nutritional energy required to support around 700 people, which is the total estimated population in the region during Late Catanga times. If the basic diet was based on a combination of maize and cassava, then an optimal combination would be 55 hectares of maize and 161 hectares of cassava. The upper line represents the total production of all available raised field area that potentially could be cultivated by the inhabitants. The polygon formed between the X-Y axes, the upper and the lower lines represents the potential for surplus production of the region.

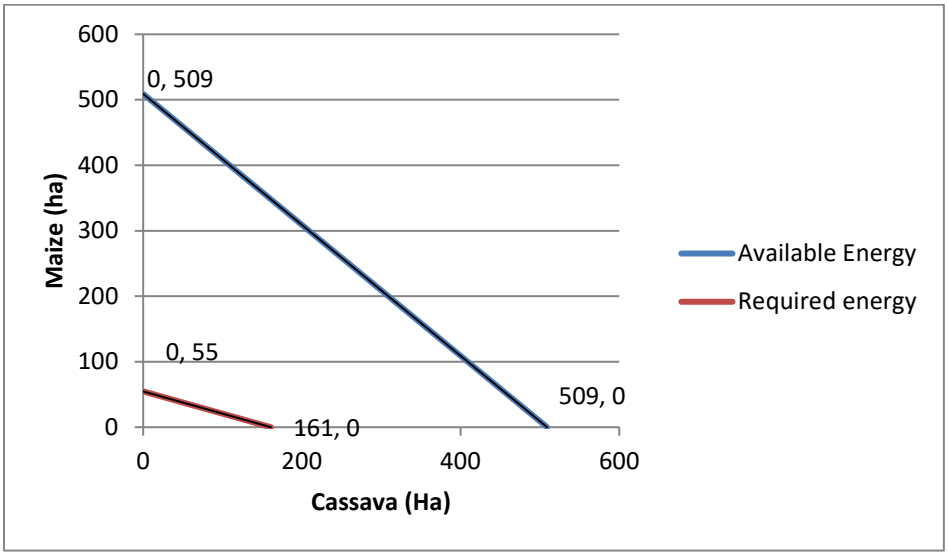

Figure 4.7 Agricultural production in the area of studio with maximum estimated population. Available energy and required energy based on maize and cassava production.

Linear programming analysis has been useful for predicting agricultural production and consumption. The results demonstrate that population could be supported with just a portion of the total area of raised fields and that there was abundant potential for surplus production during the Late Catanga period. Even if the raised fields were not used to their full extent, there was still possible that people produced considerable surpluses that could be directed toward the political economy of the supra-local community, an observation that concurs with what has been observed in Barinas. The consideration of a mixed diet based on two staples, maize and cassava, pays attention to the suggestion that in the past people farmed based on multi-cropping.

A second method by which agricultural surplus production was evaluated uses linear programming to estimate the number of people that could be supported (the potential population) based on raised field production. For this method, the prediction just included 50% of the raised fields, considering that it is very likely they were not built or under cultivation at the same time, and also that fallowing is necessary to the recovery of fertility of the plots after some years of use. To do this, it was necessary to define the best combination of the number of hectares farmed in maize and cassava that supports the maximum population (Table 4.7). The minimum constraint indicates that a combination of 137 hectares of maize and 68 hectares of cassava could support around 2000 people. When just maize is considered, around 2700 persons could be fed with the production of 205 available hectares. In contrast, when the 205 hectares are cultivated with just cassava the maximum population is reduced to 900 persons.

Figure 4.8 illustrates these three situations. Again, the X-axis corresponds to the number of hectares sowed with cassava, the Y-axis corresponds to the number of hectares sowed with

maize. In this situation, the constraint was defined in a different way. The minimum constraint corresponds to the available 205 hectares for farming. If the goal of farming is to maximize the returns, with a ratio of 2:1 in maize-cassava proportions, means that 137 hectares of maize and 68 hectares of cassava would be under cultivation. With this combination, a total of 2125 persons could be supported. This situation is represented in the graph by the lower line. The upper line represents the case in which the complete 205 hectares were cultivated only with maize or only with cassava. In the first case, a regional population of 2,725 persons could be supported. In the second case, 926 persons could be fed. These results suggest that the prehispanic populations of the Catanga region could produce from moderate to large amounts of agricultural surpluses even using just part of their raised fields.

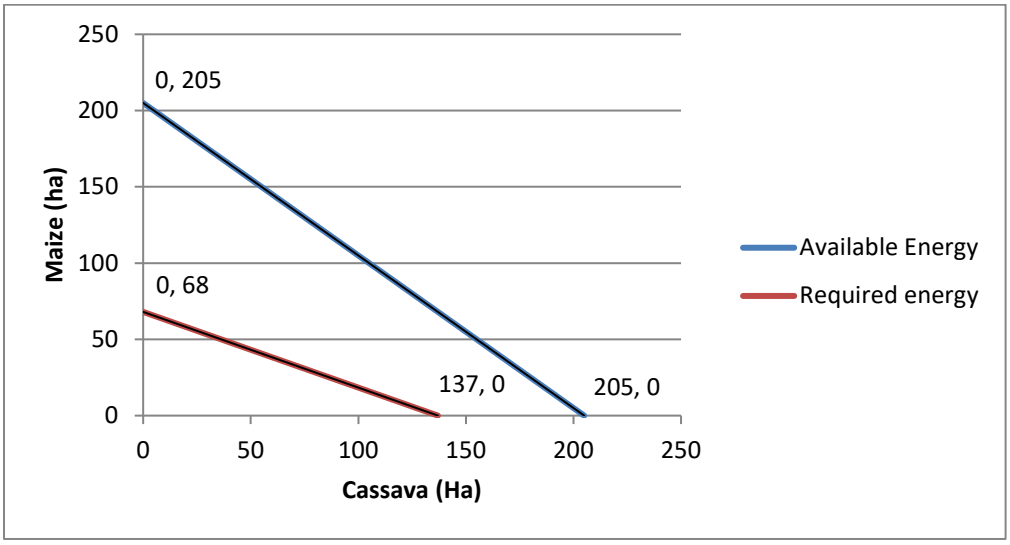

Figure 4.8 Potential population based on cassava-maize regime and farming of 50% of the total area of raised fields.

Table 4.7 Potential population based on cassava-maize regime and farming of 50% of the total

Variable	MAIZE	CASSAVA
Labor investment per hectare per year (Kcal)	310,588	660,000
Kcal output per hectare per year	6,375,000	2,720,000
Daily per capita intake (Kcal)	1,250	1,250
Daily Caloric needs (Kcal)	2,500	2,500
Yearly energy needs per person (Kcal)	456,250	456,250
Ha available to be cultivated	205	205
Potential production per one crop (Kcal) per year	1,243,204,460	422,300,000
Potential population based only on one crop (# persons)	2,725	926
Mixed cultivars constrain (# ha)	137	68
Potential production based on mixed production (Kcal)	828,802,973	140,766,667
Potential population based on mixed crops (# persons)	1,817	309
Total population based on mixed crops (# persons)	**2,125**	

Agricultural projections demonstrate that even if just a portion of the total area of raised fields were under cultivation, it was possible to produce and accumulate enough surpluses to use them socially and politically. Linear programming also was helpful to understand that based on the labor force of a proportion of the population, it could be possible to fulfill the subsistence needs of the whole population and produce surpluses. Probably, this latter observation could be

useful to explain why people decided to implement raised field farming because if the problem for agriculture was the scarcity of labor, this agricultural strategy could be helpful to deal with it. Raised fields could be constructed with communal labor, after that they could be maintained by a small labor force for many years, more than swidden fields. That means that although probably the initial investment was higher than in other farming practices, through time these labor investments remained accumulated on the landscape as a form of landesque capital (Stone 1996).

The results of the two linear programming simulations presented above suggest that it is very likely that raised fields were used to increase the agricultural productivity in the region. It is possible that this farming strategy allowed the local and regional elites to accumulate enough surplus to finance their strategies. Once this capacity for surplus production has been established we can to consider how these surpluses could be mobilized and appropriated by the elites.

4.4 AGRICULTURAL LABOR ORGANIZATION AND LEADERSHIP EMERGENCE

The understanding of how labor was organized and how surpluses were mobilized is critical to the study of the foundations of social inequality and the development of leadership (Erickson 2006; Feinman 2006; Kirch 2006: 209; Marcus and Stanish 2006; Scarborough 2006; Stanish 2006; Stone 1996: 12; Walker 2004). The archaeological record from Catanga suggests that the scale of production and the population size of these communities was small in comparison to those from

Barinas. These differences imply different kinds of problems that each polity had for the coordination of agricultural activities.

The societies from the Llanos of Barinas were larger in size and population than those from the Catanga region. During Late Gaván times, the population of the Gaván polity occupied 125 ha, while in El Cedral around 600 ha were occupied. In contrast, during Late Catanga times just around 50 ha were settled in the Catanga region. When the extent of the raised fields is compared among these three polities there is also a large difference between them: in El Gaván region around 900 ha were covered by raised fields, in El Cedral 2100 ha, and in Catanga around 500 ha. In the two first cases, the estimated regional populations during the Late Gaván period were around several thousand of people, while in the Catanga region the estimated population during the Late Catanga period was less than one thousand people.

It is very likely that the differences in demography had generated variability in the capacity of these societies to produce and mobilize surpluses and develop a large-scale economy. To analyze how the agricultural regime of each of these societies was organized, it is useful to study the different pathways that they followed. It is likely that under a production regime such as that implemented by the Bari communities, those from Catanga could experience some constraints related to the available labor force for increasing the production of surpluses. Whitehead (1994), Drennan (1996) and Gassón (1998) agree that the critical element in the Llanos for farming was labor force but not land. Under these circumstances, the spectrum of political strategies that emergent rulers from the Catanga's local communities could have developed was limited to those strategies such as feasts and external exchange that did not

require the investment of large amounts of surpluses such as monumental architecture. In that way, agricultural labor could be organized at the household level or could involve several families of a local community. Hence, it is likely that the elite families could be involved directly in the production, mobilization and appropriation of surpluses, in a similar way to the Bari nowadays.

In the Llanos, there is a direct relationship between the amount of available labor force for farming, the magnitude of raised field areas for farming, the magnitude of available surpluses, and the magnitude of the monumental architecture constructed in each region. Netting (1974) has argued that the relevant question here concerns the conditions under which agricultural intensification takes place and the necessary techniques and costs for realizing various levels of returns. The archaeological record suggests that the polities from Barinas had had a higher return than those from Casanare. The difference in the capacity to produce agricultural surpluses is not just the result of the different population sizes in each region (or the available labor force), it is also a consequence of the different strategies of labor organization that each polity implemented.

Labor force and organization of labor are affected by the specific demographic settings of the local communities and the polity. While Johnson (1982) has stated that residence unit size is related to labor requirements and form of land tenure, Stone (1996) has remarked that agriculture involves social issues like the size of the work groups, the duration of the work, and the ability of the communities to meet the labor demands. The organization of labor also imposes some requirements such as the effective transmission of information between the members of the households of a local community and between the communities integrating a polity. This

information is necessary to perform and coordinate tasks required during the farming process such as clearing, burning, planting, weeding and harvesting of each field. Johnson (1982) has argued that there is a relationship between system scale and organization and that the expansion of organizational and/or population size is probably related to demand for labor.

When population sizes, organizational requirements, and the capacity for surplus production are evaluated together, as in the case of the polities from the Llanos, it is possible to consider that the differences in the distribution of raised fields and settlements are related to different labor and social organizational forms. Johnson (1982) has argued that increasing hierarchical complexity is associated to both increasing degree of control and increasing elite access to resources. Gassón and Rey (2006) has argued that the differences in the distribution of raised fields between El Gaván and El Cedral express different strategies of mobilization of surpluses and sociopolitical control. It is likely that the organizational structures of El Gaván and El Cedral polities were more hierarchical and complex than the Catanga polity. If so, it is probable that a larger population and a more hierarchical organization brought opportunities to the elites in Barinas to mobilize and appropriate larger surpluses to finance their political and ideological activities such as the construction of monumental architecture (Spencer 1994). On the other hand, in a regional setting such as in Catanga, in which the size of the population was small, it is likely that a less hierarchical organization had emerged. The demographic and organizational features of these communities probably constrained the amount of surpluses that the emerging rulers could accumulate to promote their political aims. In such scenario, the manipulation of the kin network and feasting could be critical to the supra-local integration and the consolidation of the regional leadership exerted by the emergent rulers from Catanga.

Although the settlement patterns in these regions are similar in terms of their constructive methods, it does not mean that the agricultural system implemented in each of them was the same. The demographic scale of the Catanga local communities, the dispersed and fragmentary distribution of raised fields and the absence of archaeological evidence that suggests the accumulation and transformation of large amounts of surplus labor, could be related with the fact that the local communities from the Catanga region practiced intensive swidden agriculture.

It is possible to consider the co-existence of different patterns of occupation and land use, for example: permanent and nucleated villages, semi-permanent cultivators' settlements, and sporadic occupation of task oriented groups. It is likely that raised fields located away from the nucleated villages were related to the semi-permanent small occupations as it is evident in small densities of archaeological materials in El Medano and El Viento sites. In addition, the scale of raised field systems suggests that it was also possible to mobilized labor from nearby villages for their construction, maintenance and cultivation. The distribution of nucleated settlements related to the raised field systems allowed the effective defense of the agricultural infrastructure and facilitated the mobilization of crops toward the villages. These factors and the productive characteristics of the soils facilitated the implementation of this farming technology and became economically efficient in terms of costs/benefits. If we consider that, according to the archaeological evidence, the raised fields probably were constructed during the transition between the Middle Catanga and Late Catanga periods, this was an accelerated transformation of the regional economy and the landscape that it is also expressed in the intra-site analysis.

The analysis of labor organization allows the recognition not only that complex societies from the Llanos practiced raised field agriculture to produce surpluses (Figure 4.9), but also that their demographic differences could represent an important factor to understand the circumstances and conditions in which leadership emerged and was exerted. Demographic differences could be related with the implementation of different farming systems which depending on their extensive or intensive nature could produce different returns. The differences in the archaeological record between regions could represent variability of the conditions and pathways in which agriculture was developed, transformed, and used during prehispanic times.

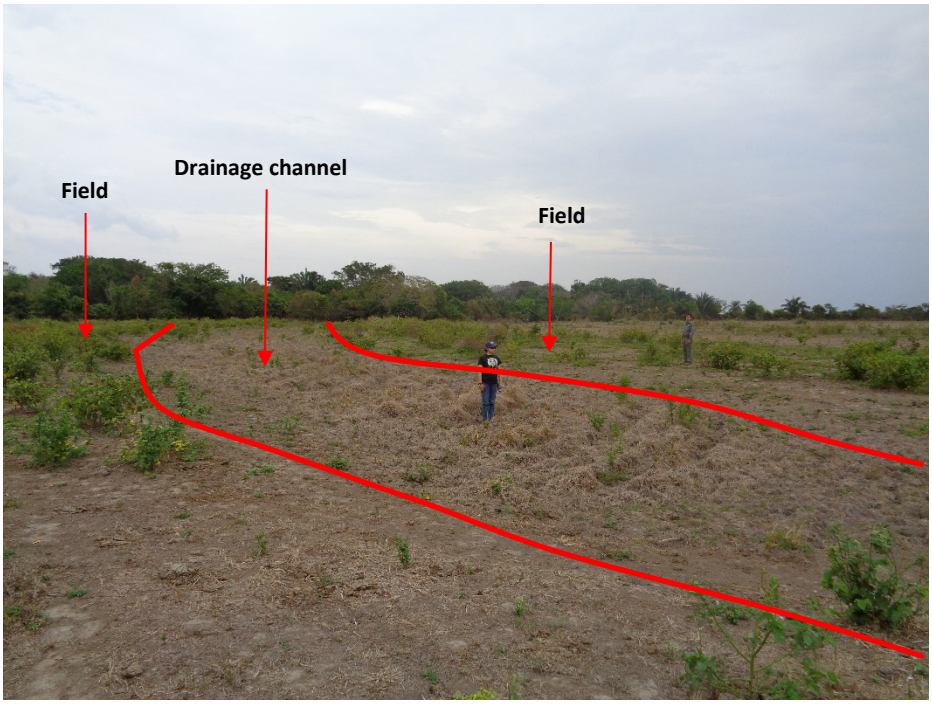

Figure 4.9 Raised Field Complex. El Viento archaeological site.

5.0 CEREMONIALISM, DEMOGRAPHY AND THE EMERGENCE OF REGIONAL LEADERSHIP IN CATANGA

The Spaniard priest Rivero traveled across the savannas of Casanare and the celebration of feasts among the native population called his attention. Rivero (1956) described the way in which the Achagua celebrated their important events. During the day, the chief's dwelling or "caney" was adorned and prepared for the celebration. When night fell, the guests arrived and took seats inside the caney and started to drink and eat until all the chicha (alcoholic beverage made of manioc) and the food was consumed. Archaeologists agree that in the Llanos of the Orinoco chiefs controlled ceremonialism (Gassón 1998; Spencer 1993; Whitehead 1994). Rivero's description suggests that these ceremonies were directed not just to the public consumption of alcohol and food but also were important to political negotiation and the aspirations of the host chiefs. Rivero's description also provides important details about Achagua local community social organization suggesting that ceremonial contexts allowed the reinforcement of the chief's status among the rest of the subject population.

This ethnohistorical description can be used to generate some archaeological expectations. For instance, if Rivero's description is accurate, we would expect differential intra-site spatial distribution of some artifacts such as decorated ceramic serving vessels. If vessels in

which more energy was invested (in terms of labor and invention) were associated with ceremonial areas and that the ceremonies were controlled for individuals of renown and prestige, we would expect a strong association between elite activity areas and high proportion of these more costly ceramics. Gassón (1998) has suggested based on the analysis of proportions of serving vessels that there were marked differences in the consumption of these artifacts among communities in El Cedral region. In the Catanga region, the number of complete vessels recovered during the survey was limited because sherds were mostly small and medium sized. In El Gaván region, it is possible to observe a differential pattern of distribution of serving vessels within the archaeological site B12. Elite households "would have been engaged in relatively more hosting and feasting activities and thus would utilize relatively more serving vessels" (Spencer and Redmond 2014, 355).

In a region, such as Catanga, where the number of complete vessels recovered is very limited; it is difficult to carried out formal - functional analysis. Lertrit (2003) has suggested that the use of rim sherds to reconstruct vessels function is problematic because they are not good indicators to consistently distinguish vessel forms. The use of ring-base vessels is equally problematic for defining vessel forms. For these reasons, in my analysis I decided to use decorated sherds on the assumption that if elites were involved in ceremonial and feasting activities they would use decorated ceramics in these activities. Ceramic decoration has been recognized as related to aggrandizers (Clark and Blake 1994). Plog (1978) has argued that ceramic decoration shows patterns of social differentiation and that the variable distribution can be related with the spatial location of social segments.

5.1 CATANGA ARCHAEOLOGICAL SITE (CA-CT)

The site was located in the highest part of a large and narrow banco, between two small streams, Caño Seco and Caño Canacabare. As mentioned in Chapter 2, the site's surface has been plowed repeatedly during the last thirty years; however, it is still possible to observe at least one rounded feature that most likely corresponds to a mounded structure. This circular mound does not exceed 1 m in height and 25 m in diameter. During the survey carried out in this site, it was possible to detect that the deposits near the mound structure were deeper than in other parts of the site, and the ceramics recovered in this area show higher proportions of decoration than those from elsewhere.

To establish where decorated sherds were more prevalent, I used the method described by Drennan (2010: 71) to estimate proportions of decorated sherds in the total assemblage from each archaeological. Error ranges has been estimated at 80% confidence level for all cases. The materials collected during the intensive survey carried out in Catanga correspond to 22 lots. During Early times, the estimated population was around 40 persons. Of the 22 lots defined, just 15 lots were settled and 11 of them showed low proportions of decorated sherds (Figures 5.1 and 5.2). Although it is possible to observe that in two lots the proportions exceed the others, when error ranges are considered, the proportions appear similar.

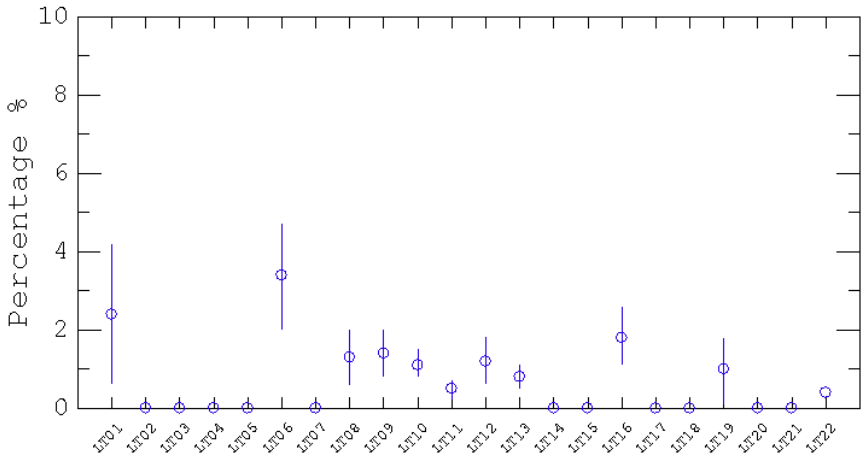

Figure 5.1 Proportions of Decorated sherds by lot, Early Catanga Period. Catanga Site.

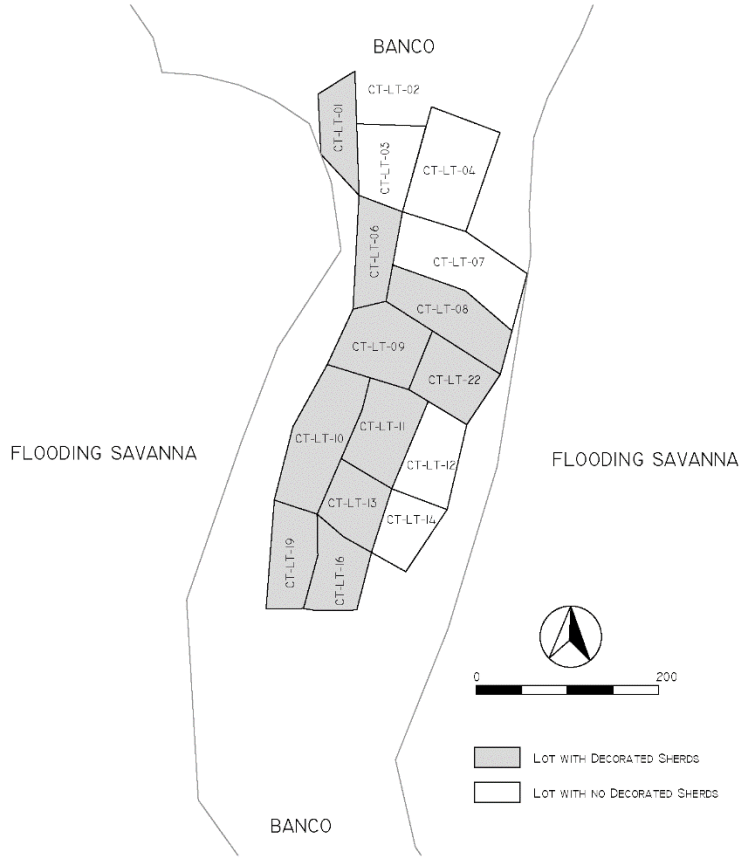

Figure 5.2 Collection lots with decorated sherds, Early Catanga times. Catanga Site.

During the Middle Catanga period, 16 lots were occupied and decorated sherds were recovered in only 11 out of the 16, decorated sherds were recorded. The estimated population for this period oscillated between 60 and 100 people. In this period, it is possible to observe that some lots such as CT-LT-09, CT-LT-10 and CT-LT-13 show higher proportions of decorated sherds (Figures 5.3 and 5.4). Although the proportions of decorated sherds in the total sample remain low, the differences between these lots and the rest are significant. According to the stratigraphy observed in the area, it is very likely that the mounded structure was constructed during this period or in the transition to the late period. This distribution also suggests that in the area, formed by lots 9, 10 and 13, during this period the intensity of ceremonialism, feasting and construction of residential architecture increased compared with the other areas of the settlement.

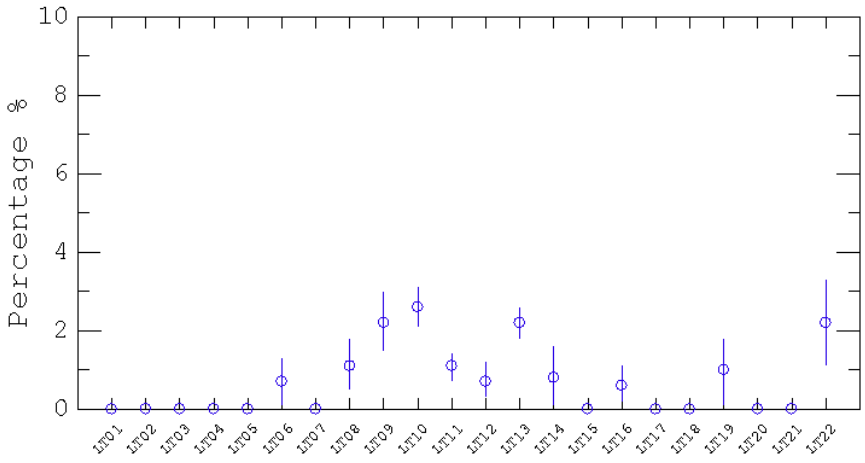

Figure 5.3 Proportions of Decorated sherds by lot, Middle Catanga Period. Catanga Site.

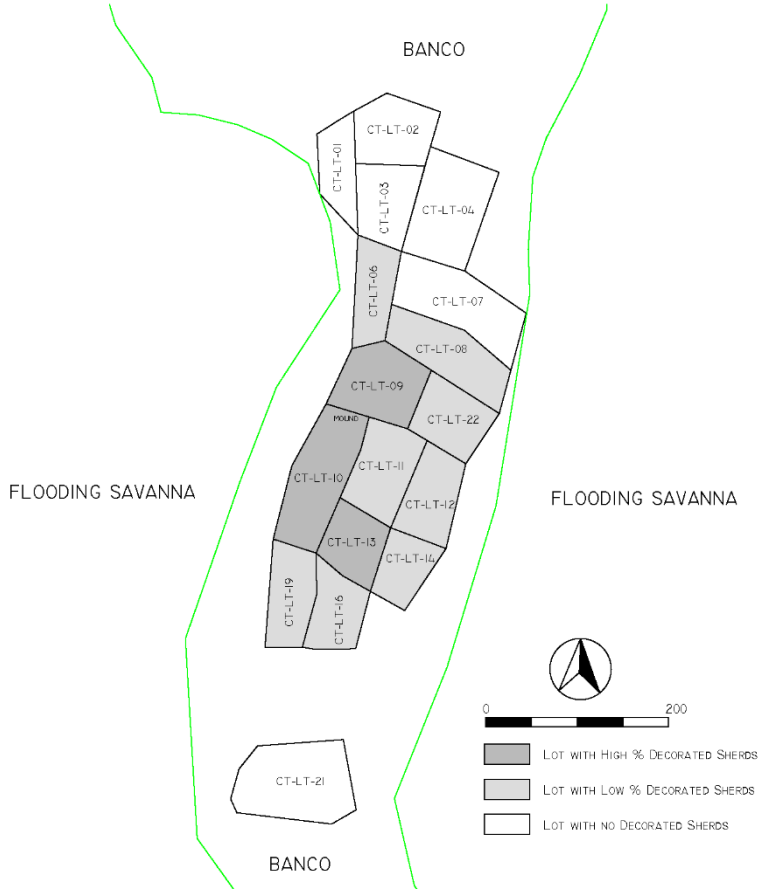

Figure 5.4 Collection lots with decorated sherds, Middle Catanga period. Catanga Site.

During the Late Catanga period the population estimate indicates around 200 to 400 people living in this settlement. Decorated ceramics were registered in 13 out of the 20 lots occupied during this period (Figures 5.5 and 5.6). Decorated sherds remain concentrated in the area associated with the mound structure, although it increased in size in later times. It is possible to divide the settlement into three areas with different proportions of decorated sherds: the central area with high proportions, some adjacent lots with medium proportions and the peripheral lots with low proportions. Based on this data, it seems that during the Late period the intensity of feasting increased, although this activity remained concentrated in the same area.

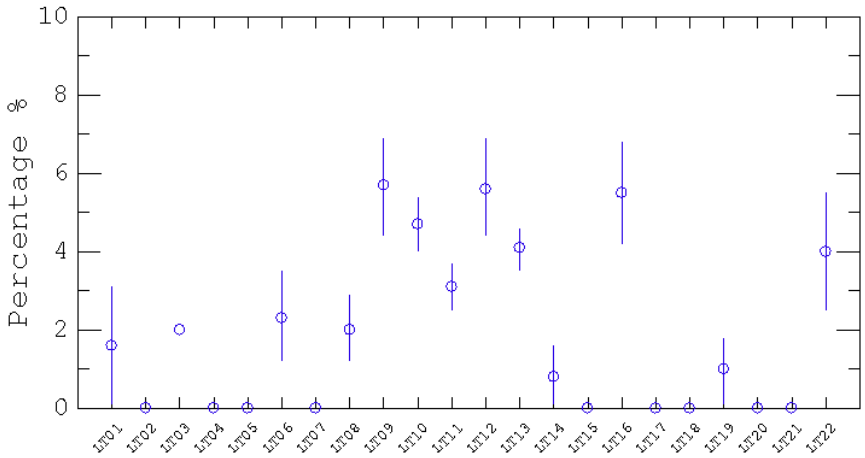

Figure 5.5 Proportions of Decorated sherds by lot. Late Catanga Period. Catanga Site.

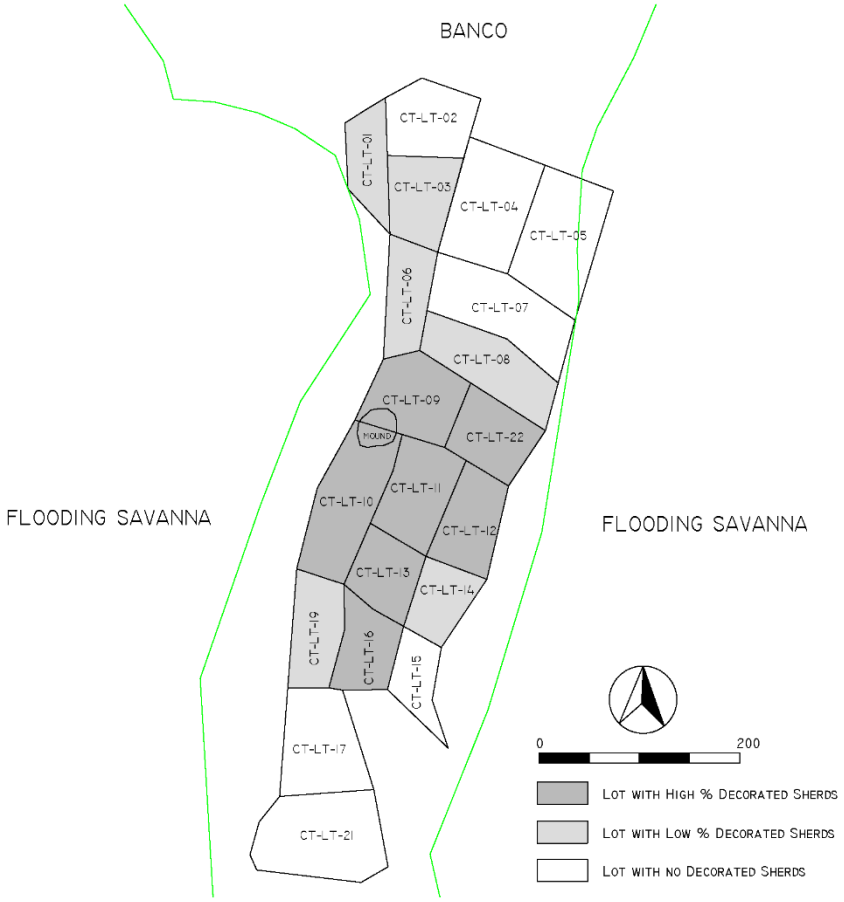

Figure 5.6 Collection lots with decorated sherds, Late Catanga period. Catanga site.

5.2 EL ARENAL ARCHAEOLOGICAL SITE (CA-EA)

During the intra-site survey of this site, two mounds of approximately 1 m high and 25 m in radius were recorded. The first mound (EA-MT-01) was located in the western part of the settlement in lot EA-LT-02 and the second mound (CA-EA-MT-02) was located in the northeastern part between lots EA-LT-07 and EA-LT-08. These mounds were constructed during Middle Catanga times. The excavations and the shovel probes in the contiguous areas of the mounds revealed concentrations of decorated sherds and figurines. However, in El Arenal the distribution of these artifacts was more continuous than in Catanga.

During the Early Catanga period, the site of El Arenal was inhabited by around 20 people. In this period, in one of the ten lots, there were no decorated artifacts. Lots EA-LT-01, EA-LT-02 and EA-LT-07, where the mounds are located or are close by, exhibit the largest concentrations of decorated sherds (Figures 5.7 and 5.8).

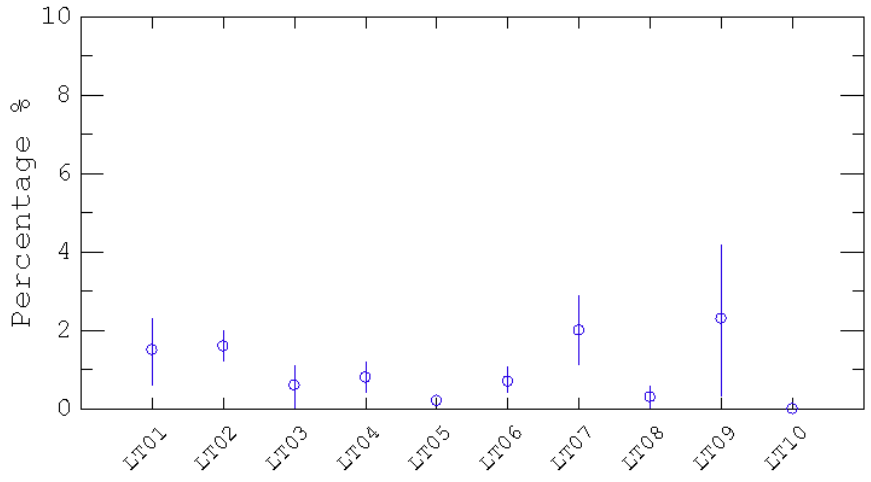

Figure 5.7 Proportions of Decorated sherds by lot. Early Catanga Period. El Arenal Site.

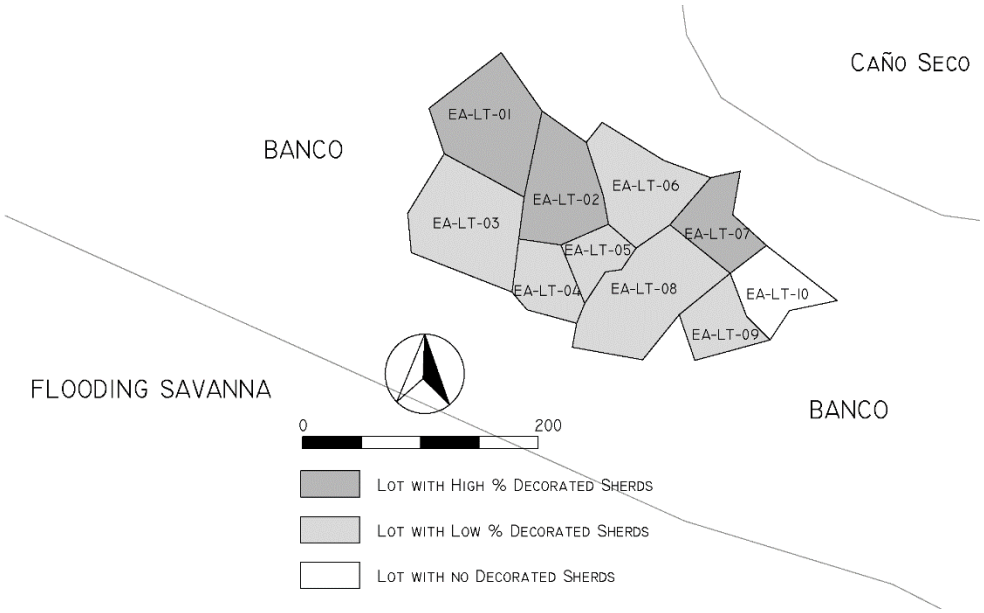

Figure 5.8 Collection lots with decorated sherds during Early Catanga period. El Arenal Site.

During Middle Catanga, the population of the site experienced an increase of 20 to 30 individuals. The highest concentrations are shown in lots EA-LT-01, EA-LT-05, EA-LT-06 and EA-LT-08, the first one and the last one located close to the mounded areas (Figures 5.9 and 5.10).

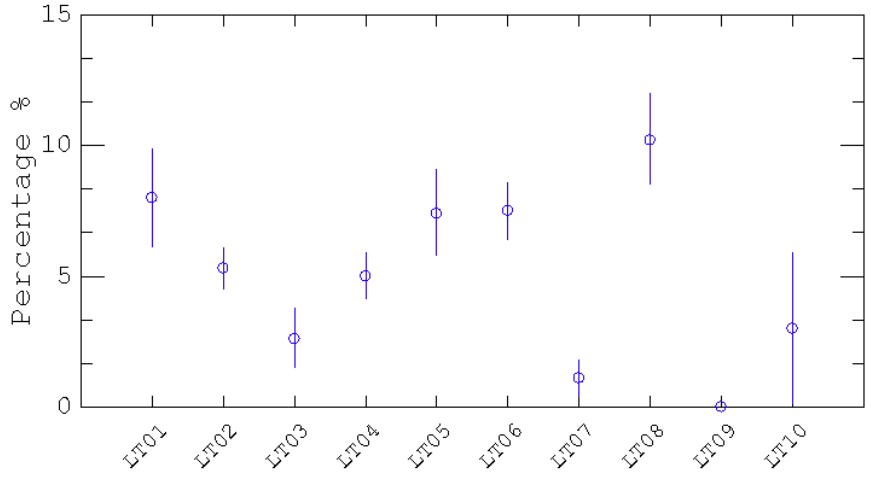

Figure 5.9 Proportions of Decorated sherds by lot. Middle Catanga Period. El Arenal.

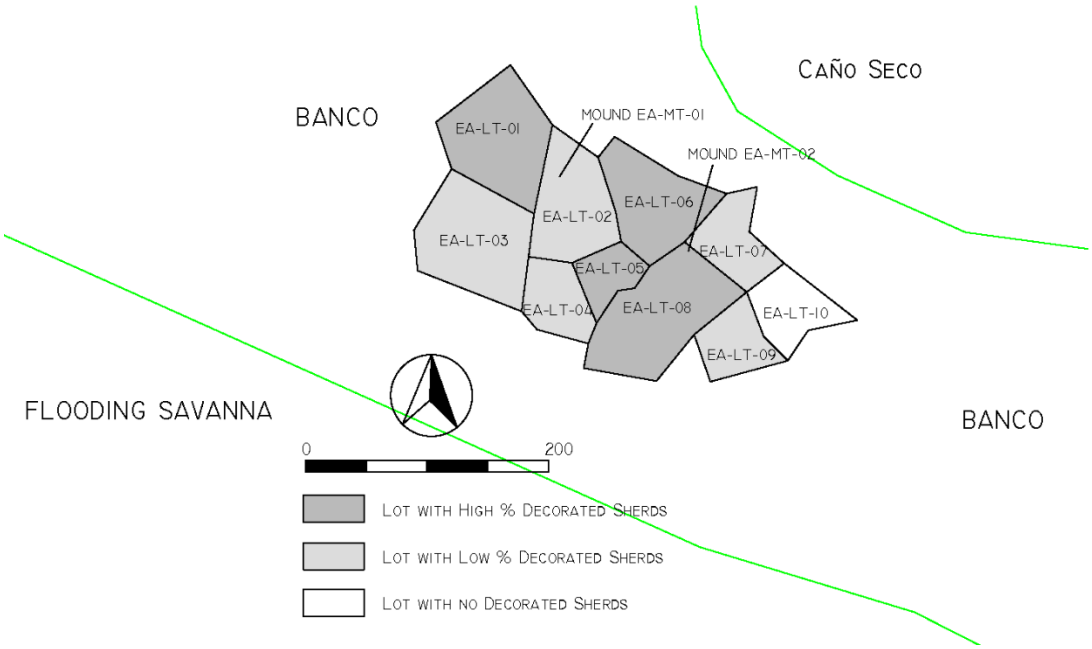

Figure 5.10 Collection lots with decorated sherds during Middle Catanga period. El Arenal.

Changes in the proportions of decorated sherds suggest an increase in the use of these artifacts, likely related to the intensification of feasting in the site. Although there are differences in the proportions associated with each lot, the artifact distribution suggests that, in general, people living in the settlement had access to decorated sherds during Middle Catanga times. The stratigraphy of the area indicates that the mounds were constructed at some moment between the Middle and the Late period which coincides with a context of ceremonialism intensification and population growth.

The patterns of spatial distribution of decorated sherds changed during the Late Catanga period at El Arenal. Population at the site experienced an accelerated growth to 80 to 160 people. Decorated sherds were present in all of the 10 lots that composed the site during this period (Figure 5.11 and 5.12); however, it is possible to observe that in lot EA-LT-02, the proportion

exceeds slightly the proportions of CA-LT-03, CA-LT-04, CA-LT-05, CA-LT-06l. The distribution pattern of decorated sherds during late times is different when it is compared with what was observed in the site of Catanga. It seems that people in this settlement had access to elaborate vessels. However, people living on the mound EA-MT-01, the largest mound, and in neighboring areas apparently consumed more decorated artifacts.

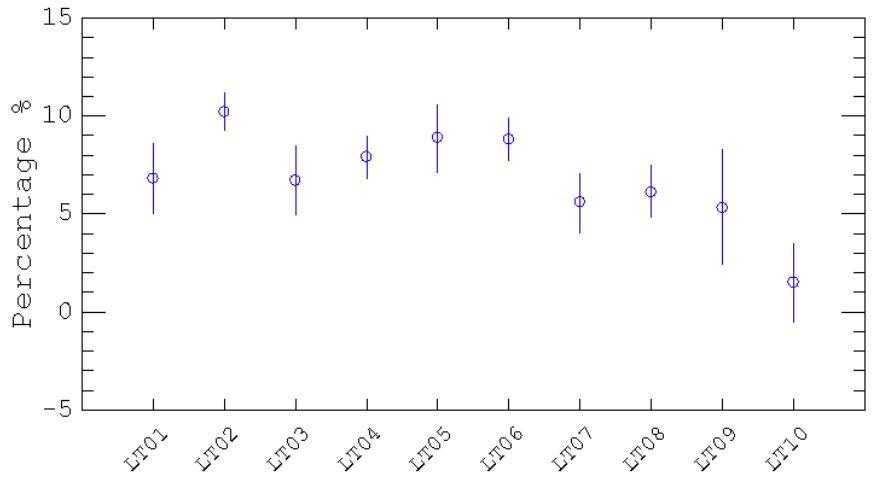

Figure 5.11 Proportions of Decorated sherds by lot. Late Catanga Period. El Arenal.

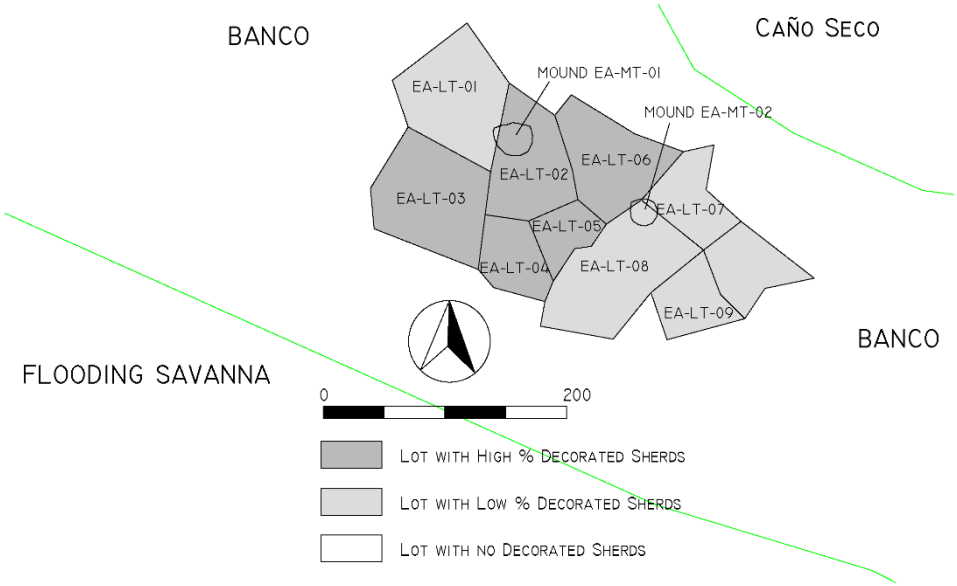

Figure 5.12 Collection lots with decorated sherds during Late Catanga period. El Arenal Site.

5.3 CORINTO ARCHAEOLOGICAL SITE (CA-CO)

Although the surface of this site has been modified recently, it is still possible to observe between lots COR-LT-02 and COR-LT-04 an archaeological feature that probably corresponds to a mound like those observed in Catanga and El Arenal. The local community of Corinto during the Early Catanga period had a population of around 10 people. Decorated sherds were distributed in 4 of the 9 lots that were occupied at this time (Figures 5.13 and 5.14). The largest proportion corresponds to lot COR-LT-02 in which a small mound, similar to those observed in El Arenal or Catanga, was probably erected.

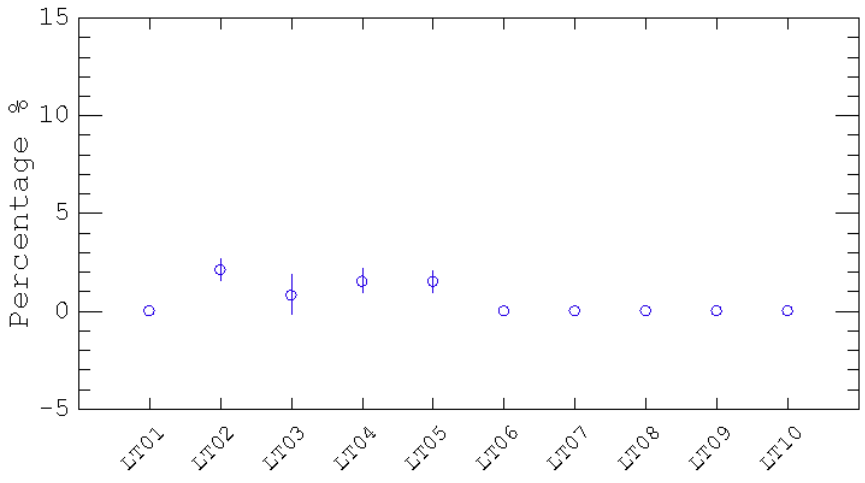

Figure 5.13 Proportions of Decorated sherds by lot, Early Catanga Period. Corinto Site.

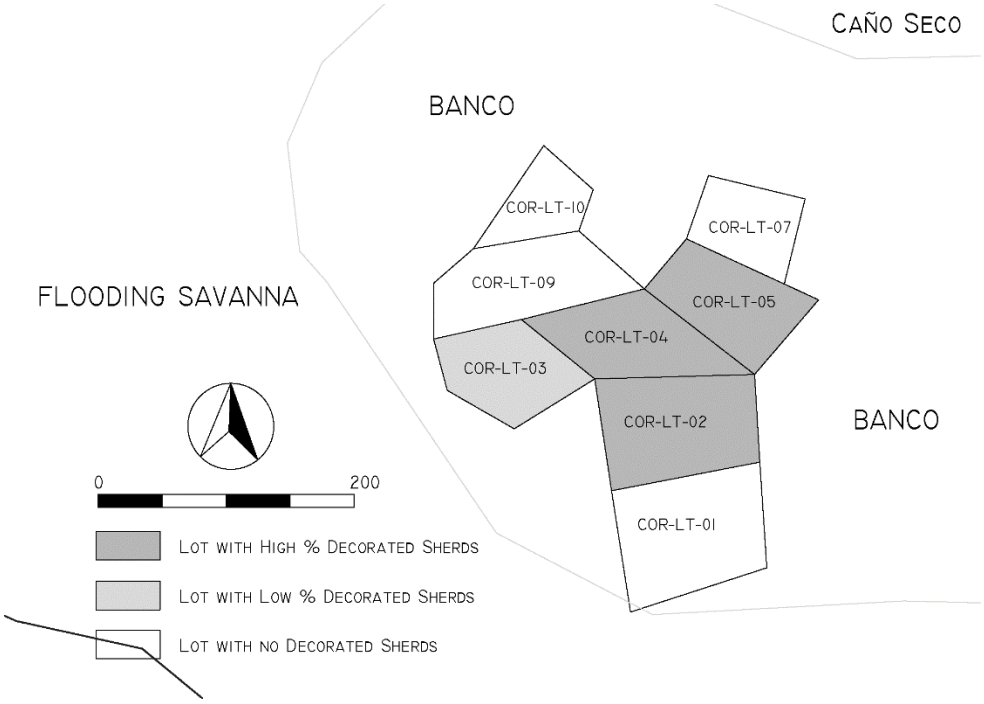

Figure 5.14 Collection lots with decorated sherds during Early Catanga period. Corinto Site.

During the Middle Catanga period the estimated population was around 20 people. Only lots COR-LT-04 and COR-LT-08 had evidence of decorated sherds (Figures 5.15 and 5.16).

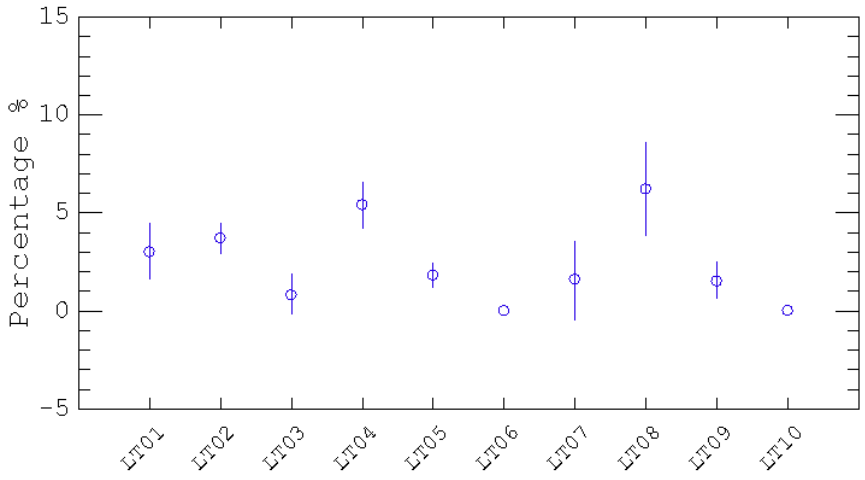

Figure 5.15 Proportions of Decorated sherds by lot, Middle Catanga Period. Corinto Site.

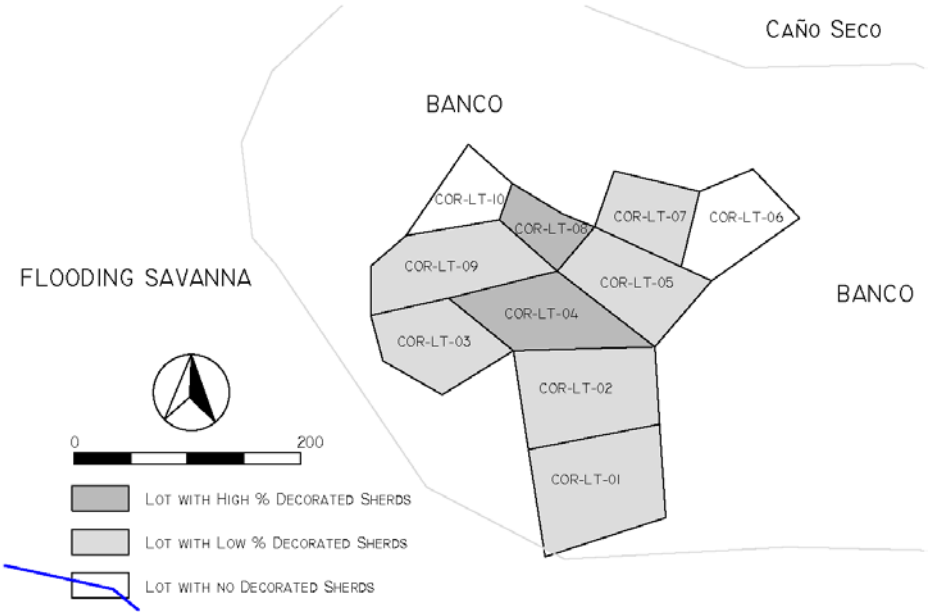

Figure 5.16 Collection lots with decorated sherds during Middle Catanga period. Corinto Site.

During the Late period, the population of Corinto grew to approximately 30 – 60 people. The distribution of decorated artifacts remained similar to the Middle period, although the largest concentration appears now in lot COR-LT-02 (Figure 5.17). It is important to note that across time, the largest concentrations of decorated ceramics are closely associated with the mounded area but the proportions did not increase much (Figure 5.18). This suggests that ceremonialism was associated with the same households, probably the first settlers of the site and their offspring. As in the case of El Arenal, access to decorated materials was generalized in the village during Middle and Late times although with some small differences. This distribution suggests that ceremonialism was at the household level and that there was no restriction in the use of symbolic markers. However, the households in the central lots participated more intensively in ceremonial activities.

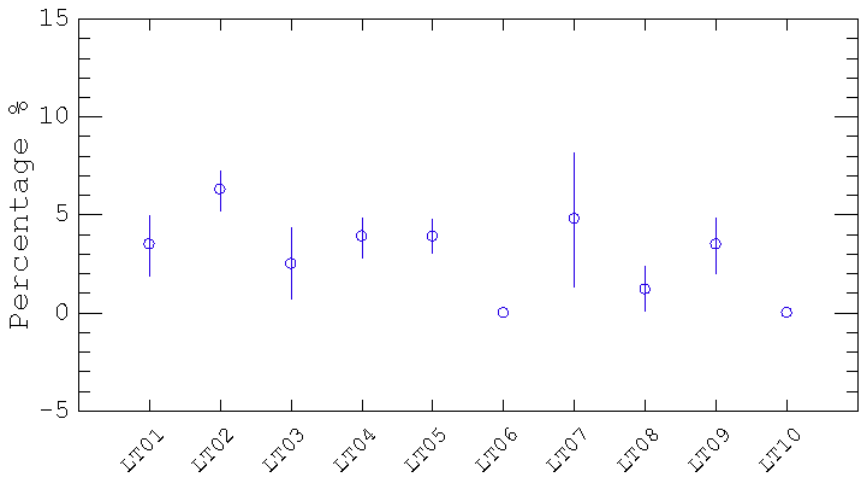

Figure 5.17 Proportions of Decorated sherds by lot, Late Catanga Period. Corinto Site.

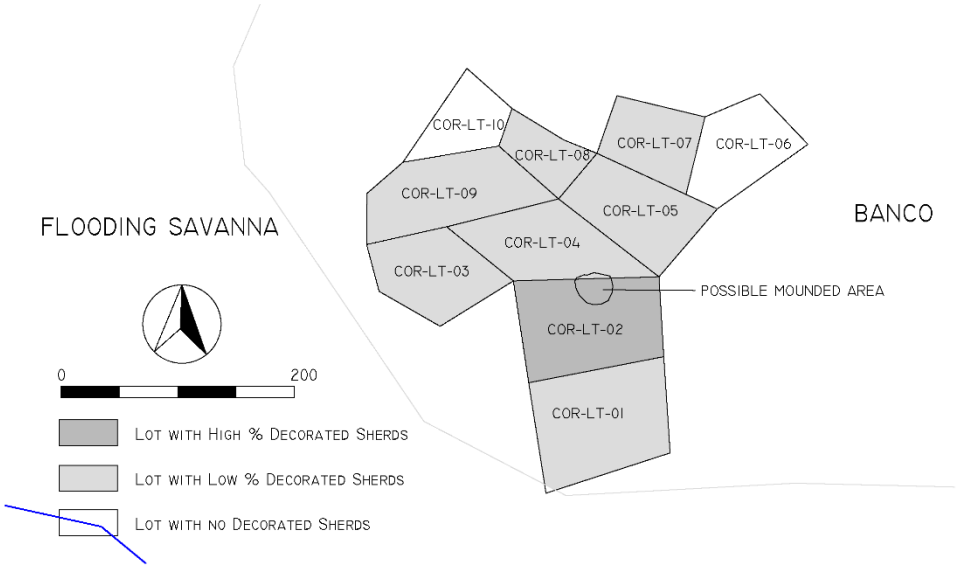

Figure 5.18 Collection lots with decorated sherds during Late Catanga period. Corinto Site.

5.4 EL PENSIL ARCHAEOLOGICAL SITE (CA-EP)

El Pensil from the beginning of the occupation was divided by a small caño into two sectors, north and south. The population projections suggest that around 10 people lived in the site during Early times. Their traces were found just in lots EP-LT-04 and EP-LT-07 (Figure 5.19), located in the southern part of the settlement, which contained decorated sherds in low proportions (Figure 5.20).

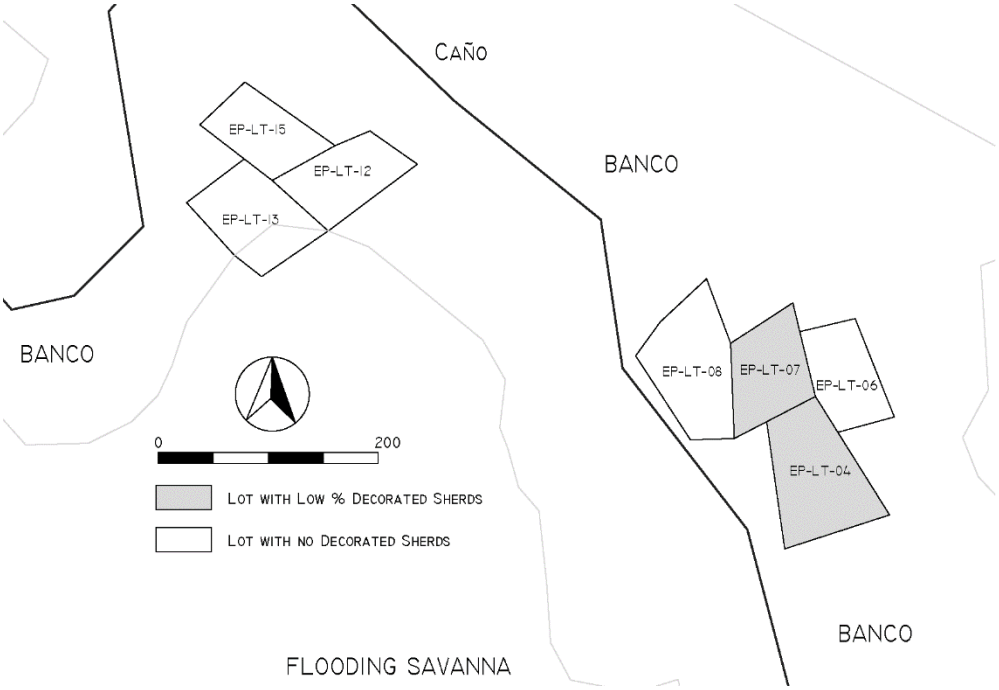

Figure 5.19 Collection lots with decorated sherds during Early Catanga period. El Pensil Site.

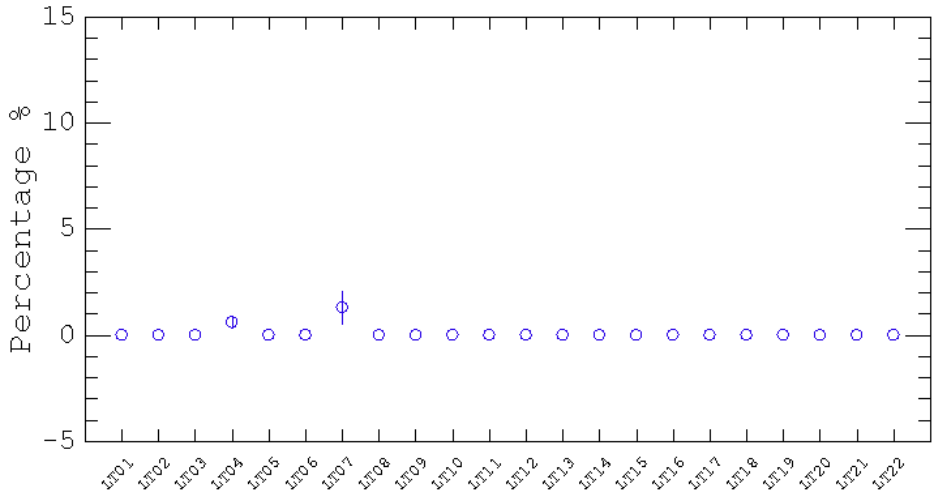

Figure 5.20 Proportions of Decorated sherds by lot, Early Catanga Period. El Pensil Site.

In the next period, Middle Catanga, the number of lots with decorated sherds increased to six and included lots at both sites of the caño. At this time, the population also grew to 30 – 40 persons. The proportion of decorated sherds increased during the Middle period in lot EP-LT-07 and it represented the highest concentration in the settlement (Figure 5.21 and Figure 5.22).

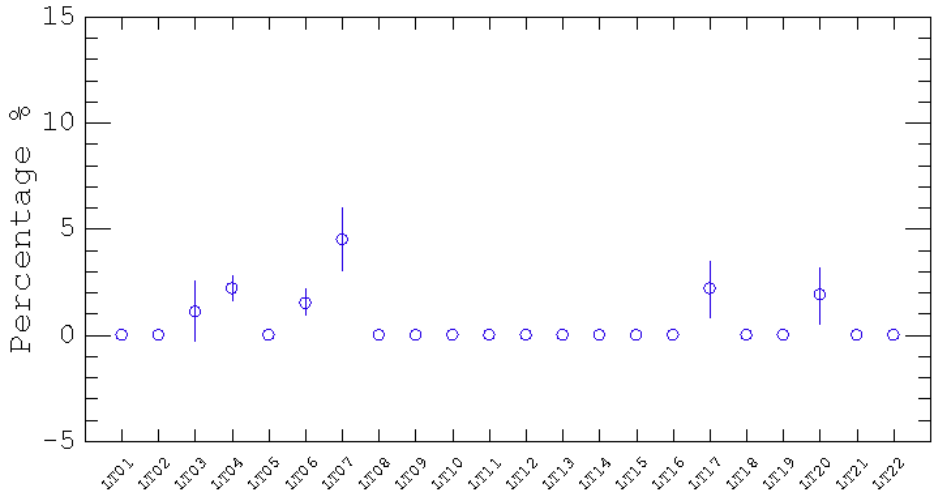

Figure 5.21 Proportions of Decorated sherds by lot. Middle Catanga Period. El Pensil Site.

In the Late Catanga period, new concentrations of decorated sherds appeared in other areas of the site. The site size has an associated population of 60 to 100 people. Although lot EP-LT-05 exhibits the largest proportion of decorated sherds, there is a large error range associated with it (Figure 5.22). In general, the lots in which decorated ceramics were present show similar proportions (Figure 5.23).

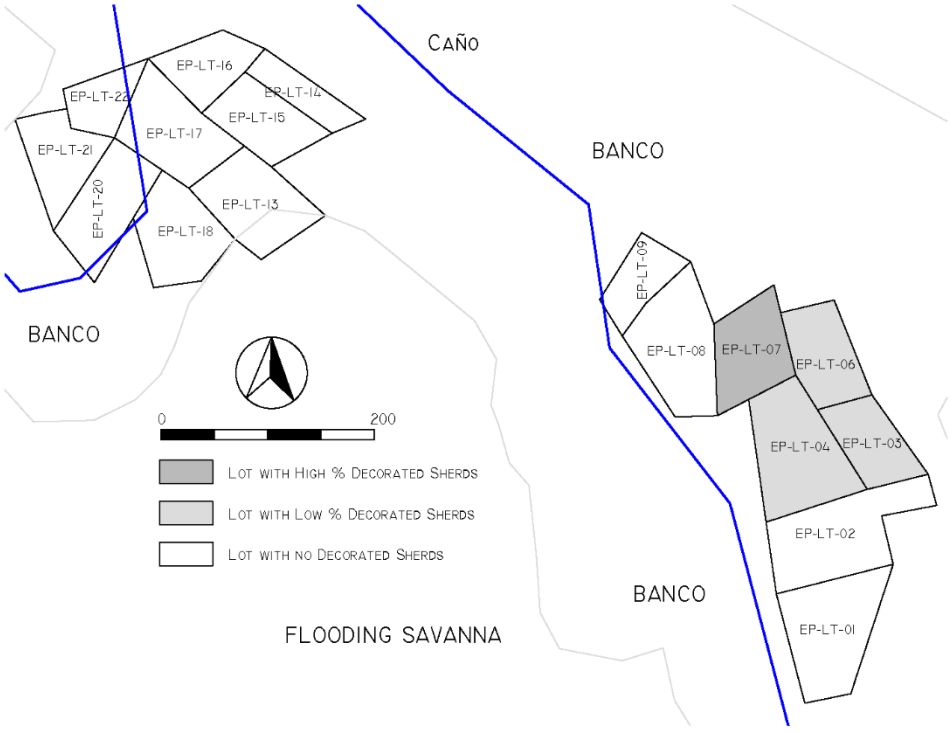

Figure 5.22 Collection lots with decorated sherds during Middle Catanga period. El Pensil.

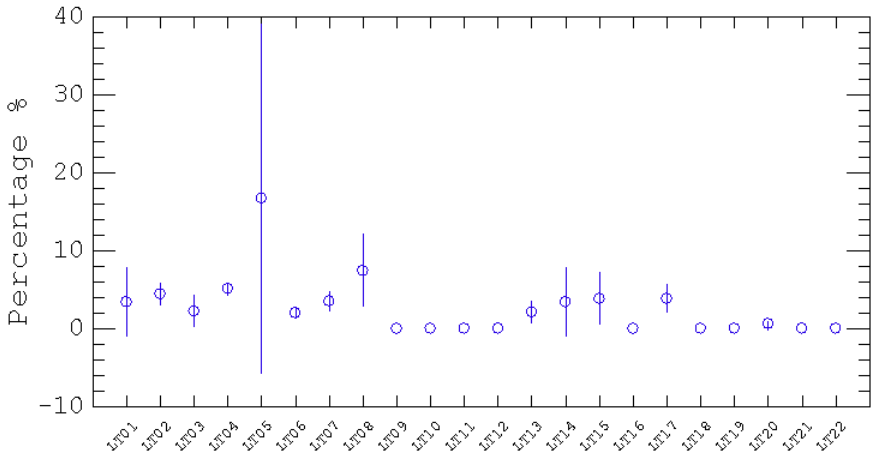

Figure 5.23 Proportions of Decorated sherds by lot. Late Catanga Period. El Pensil Site.

The patterns of distribution of the decorated ceramics in the community of El Pensil revealed changes through time that are likely related to ceremonialism. During Early and Middle times, households associated with the area EP-LT-07 had more intensive ceremonial activity than the others. During the late period, this pattern of distribution changed in that more households were participating in this activity and decorated vessels use was more evenly distributed. It is important to emphasize that decorated sherds were more concentrated in the southern part of the site. There are some landscape differences that can explain this differential distribution; for instance, in the northern part, there are alluvial terraces that probably were under cultivation.

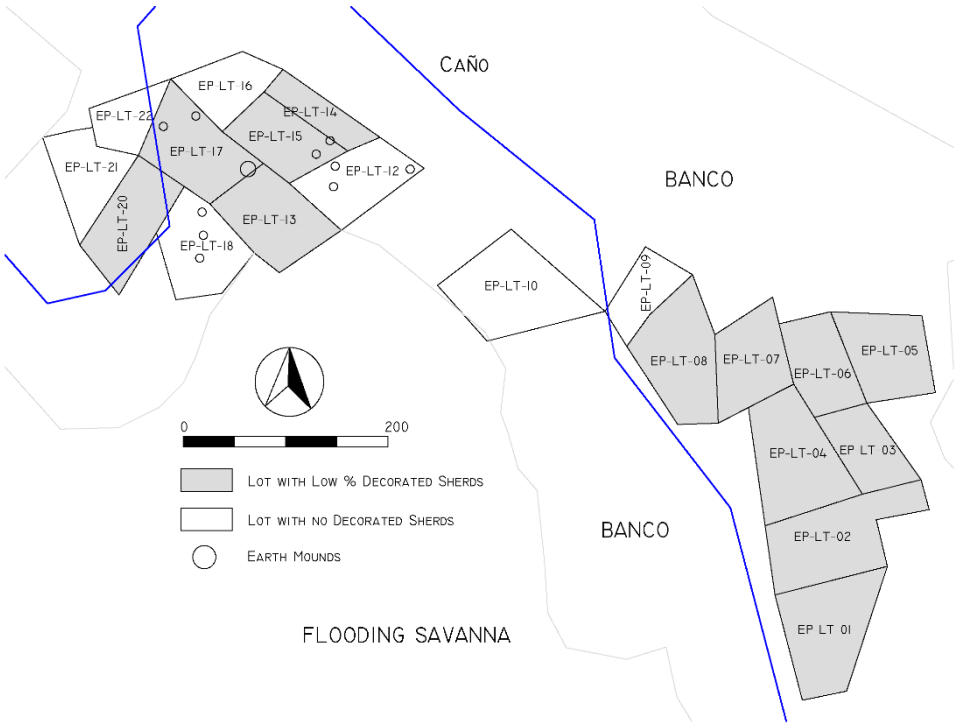

Figure 5.24 Collection lots with decorated sherds during Late Catanga period. El Pensil Site.

During the intra-site survey, 11 small mounds (1 m high – 2 to 3 m in radius) were found (Figure 5.24). Their structure suggests that they were not residential but agricultural as discussed above. This idea is consistent with the population density and the size of the settlement in the Late period. El Pensil had a size of 12.5 hectares and a density of 6 persons/ha. When these values are compared with the site of Catanga that had a similar area at this time (12.8 ha) and a density of 22 persons/ha, the fact that people were less concentrated in El Pensil is evident.

El Pensil seems to have been a very dispersed village with what amount to farmsteads in the northern part where households lived on the land that they farmed. This functional division was evident beginning in Middle times but it was consolidated during the Late period when the

maximum occupation was reached. In such a context, ceremonialism played a critical role by bringing cohesion to the local group. It is also very likely that during Late times, families participated more broadly in ceremonialism because they were self-sufficient and they could invest surpluses in these activities, however, this hypothesis needs to be tested in the future.

5.5 TILODIRÁN ARCHAEOLOGICAL SITE (CA-TL)

Tilodirán was a small farmstead during the Early Catanga period, likely composed of just a couple of households. The estimated population during this period was around 10 individuals. Just a few decorated sherds were recorded at lot CA-LT-05 (Figures 5.25 and 5.26).

The population during the middle period grew to 20 individuals. During this period, the use of decorated vessels increased and they appear concentrated in six of the seven lots. The error ranges suggest that there were no significant differences between the proportions of decorated sherds associated with each lot (Figures 5.27 and 5.28).

During Late Catanga times, decorated sherds tended to be concentrated in the eastern part of the settlement (Figure 5.29). Some lots such as TL-LT-02 and TL-LT-03 had larger proportions than the others (Figure 5.30). During the late occupation, there were 70 to 140 individuals living on the site.

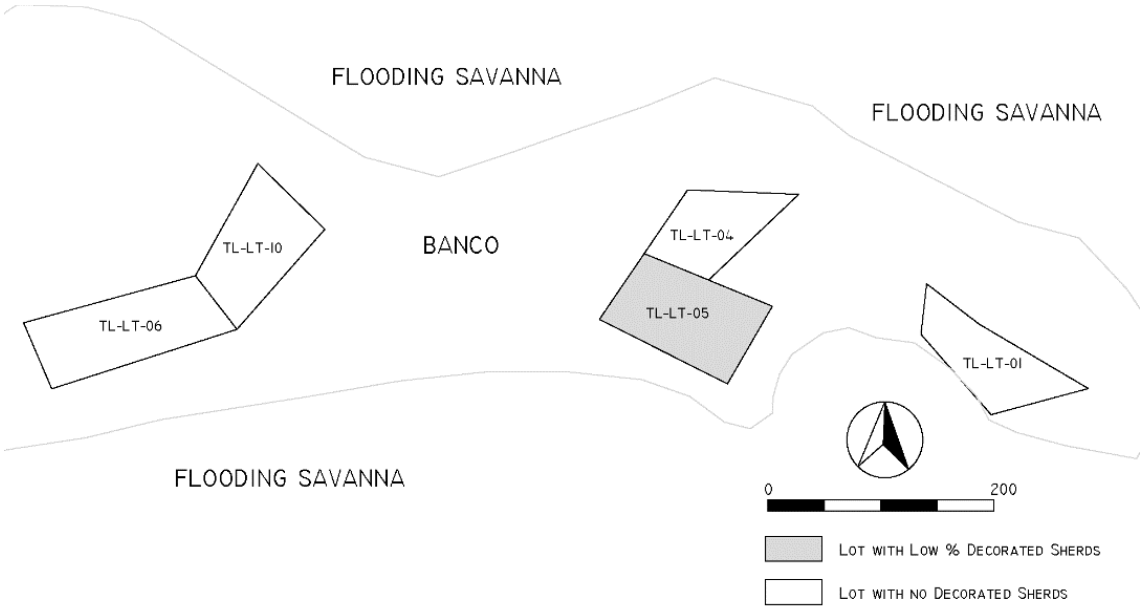

Figure 5.25 Collection lots with decorated sherds during Early Catanga period. Tilodirán Site.

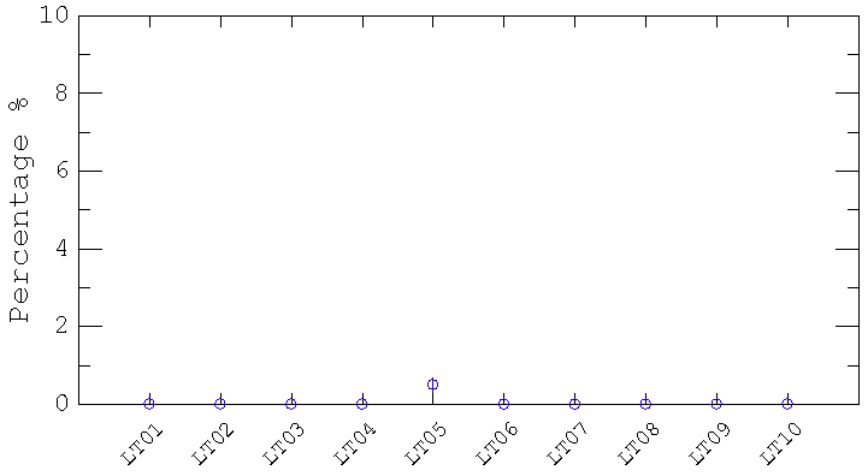

Figure 5.26 Proportions of Decorated sherds by lot. Early Catanga. Tilodirán Site

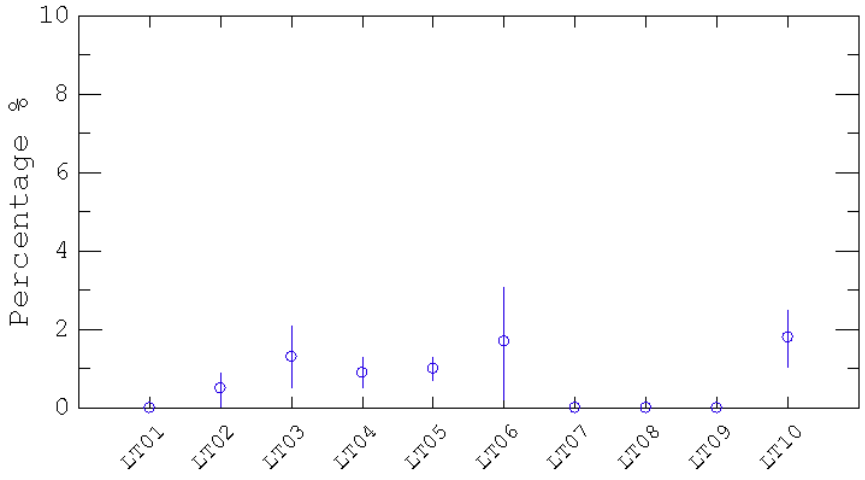

Figure 5.27 Proportions of Decorated sherds by lot. Middle Catanga. Tilodirán.

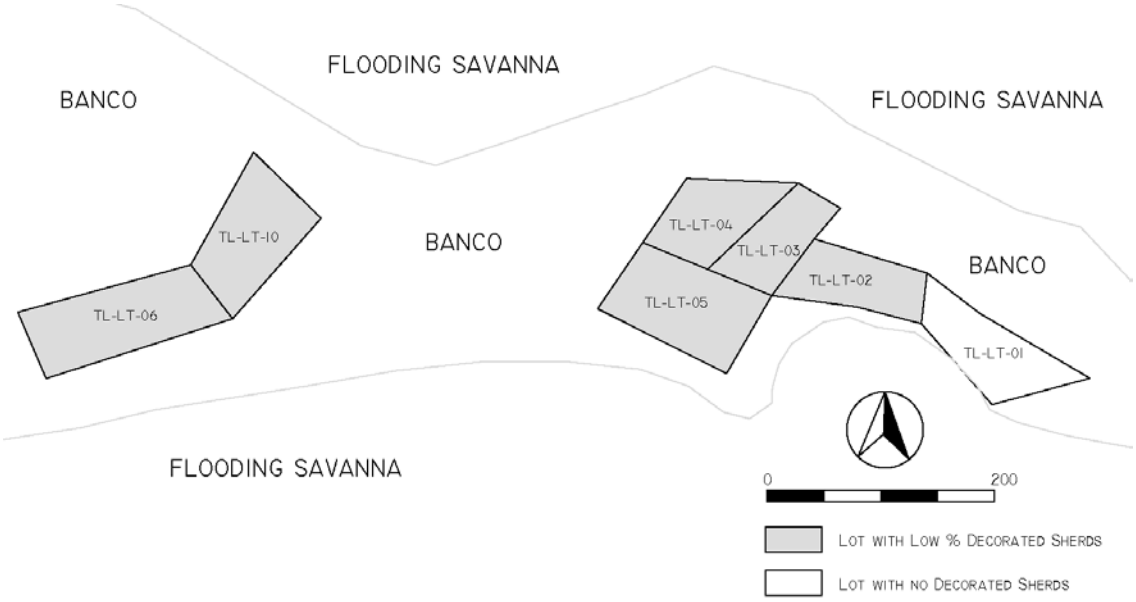

Figure 5.28 Lots with decorated sherds during Middle Catanga period. Tilodirán.

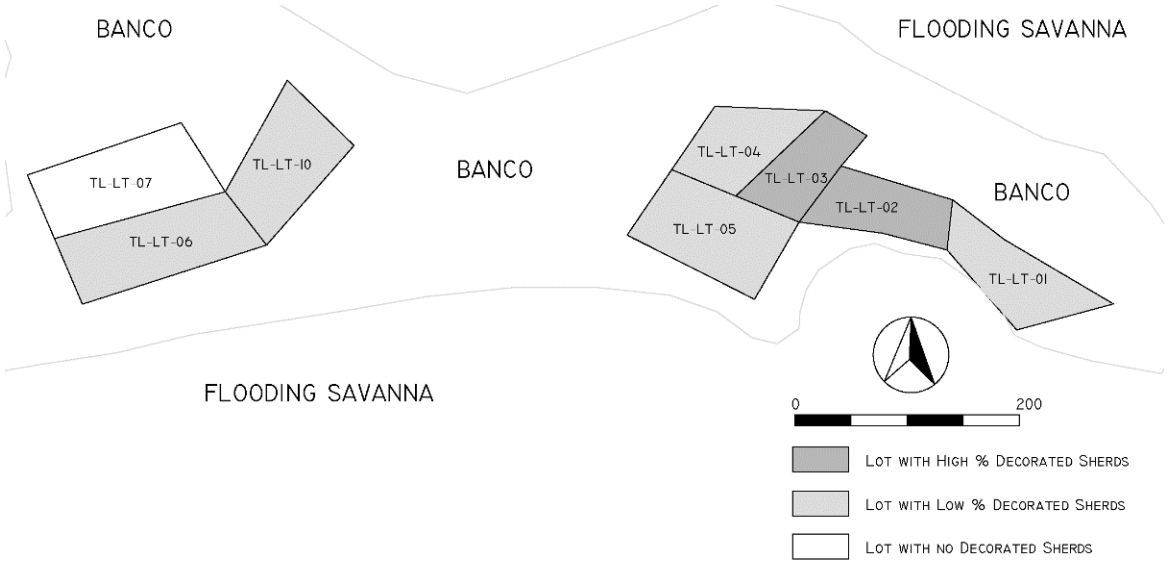

Figure 5.29 Lots with decorated sherds during Late Catanga period. Tilodirán.

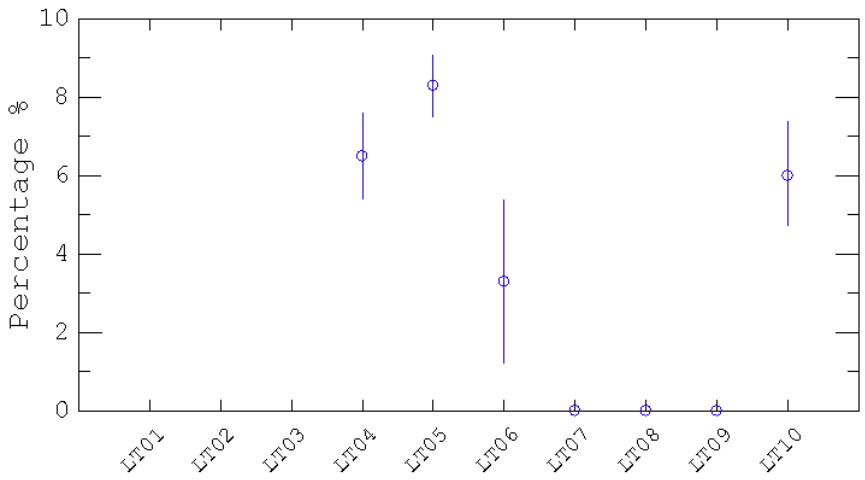

Figure 5.30 Proportions of Decorated sherds by lot, Late Catanga Period. Tilodirán.

In sum, in the archaeological site of Tilodirán during the Early period, there was one lot with decorated sherds. In the Middle period, decorated ceramics had an even distribution. During the Late period, two lots have very high concentrations, while the others have low proportions

or no decorated sherds at all. It is likely that at the beginning of the sequence, the founders of the Tilodirán site used more decorated artifacts, in the Middle period the use of decorated vessels was more generalized. During the Late Catanga period, some households intensified the use of decorated ceramics, which probably represented an attempt to control the ritual activity at the site. An alternative explanation is that in some areas this use was public; thus, creating high concentrations of decorated ceramics. However, the continuous distribution of undecorated sherds against the discrete distribution of decorated sherds and their relation in other sites with domestic architecture (mounds) seems to indicate that the use and consumption of these artifacts occurred at the household level.

5.6 SANTA JUANA ARCHAEOLOGICAL SITE (CA-SJ)

This archaeological site is located 10 km to the southeast of Catanga. It is divided by the Caño Canacabare into two sections, one to the north, the other to the south.

During the Early Catanga period around 10 people were living there. At this time, lots CA-SJ-LT-02 and CA-SJ-LT-06 located at the southern part of the settlement contained decorated sherds (Figures 5.31 and 5.32).

The next period, Middle Catanga, is characterized by slight increase in the size of the population, which at that time reached 20 individuals approximately. During this period, decorated ceramics were more wide spread and they appeared in 6 out of the 7 lots that were

occupied. There are 3 lots that show high proportions of decorated ceramics (Figures 5.33 and 5.34).

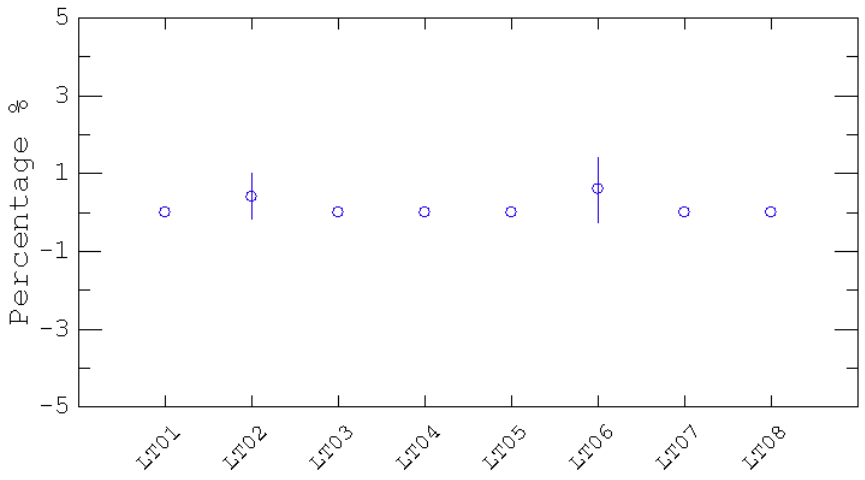

Figure 5.31 Proportions of Decorated sherds by lot, Early Catanga Period. Santa Juana.

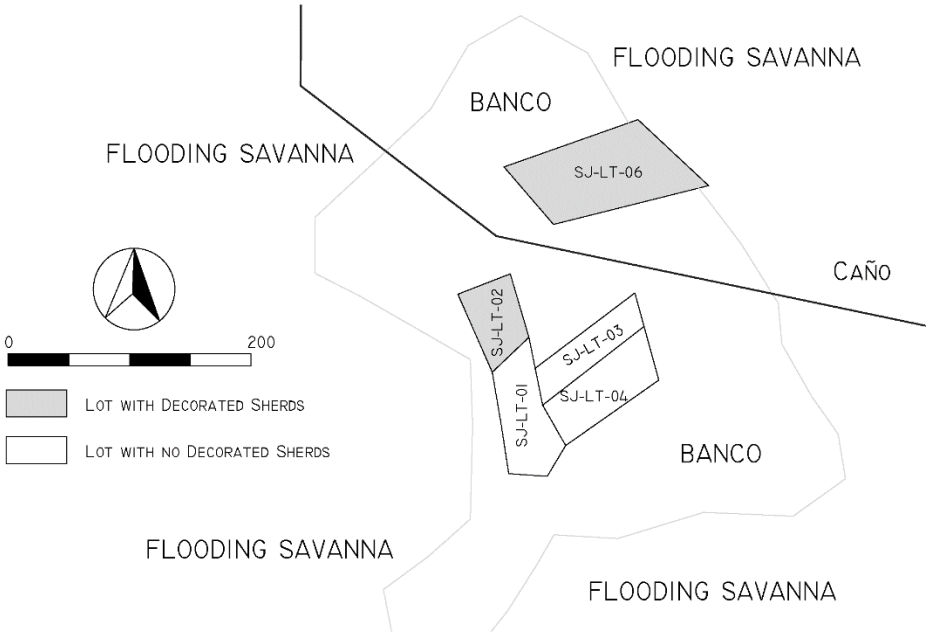

Figure 5.32 Collection lots with decorated sherds during Early Catanga period. Santa Juana.

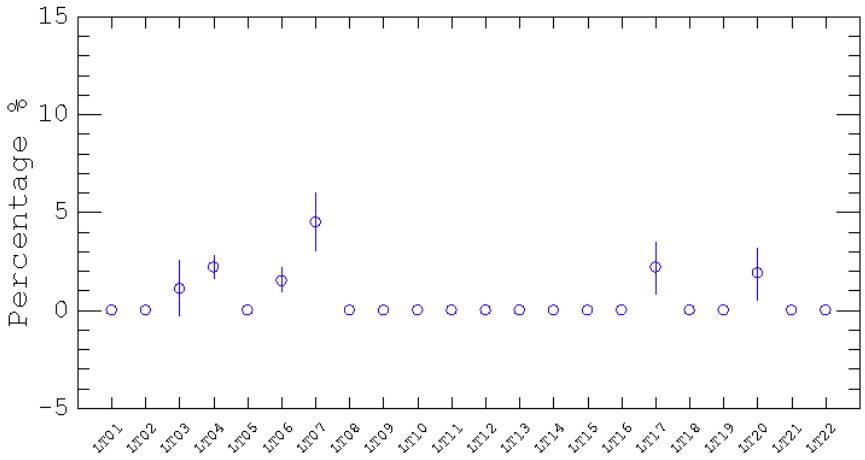

Figure 5.33 Proportions of Decorated sherds by lot, Middle Catanga period. Santa Juana.

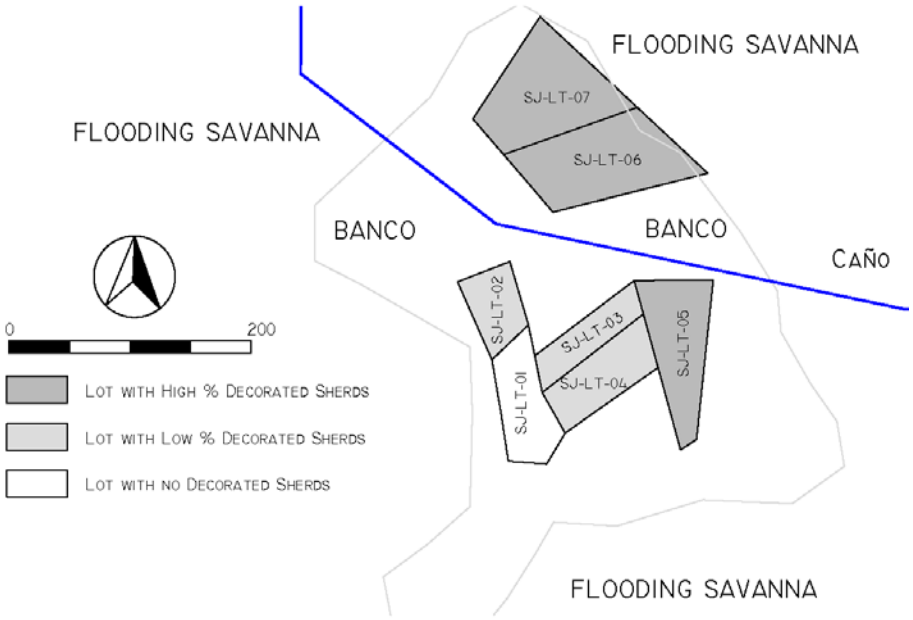

Figure 5.34 Collection lots with decorated sherds during Middle Catanga. Santa Juana.

During the Late Catanga period there are changes in the amount and the distribution of decorated sherds. 4 out of the 8 occupied lots show similar concentrations of decorated sherds, however, the proportions diminished abruptly (Figures 5.35 and 5.36).

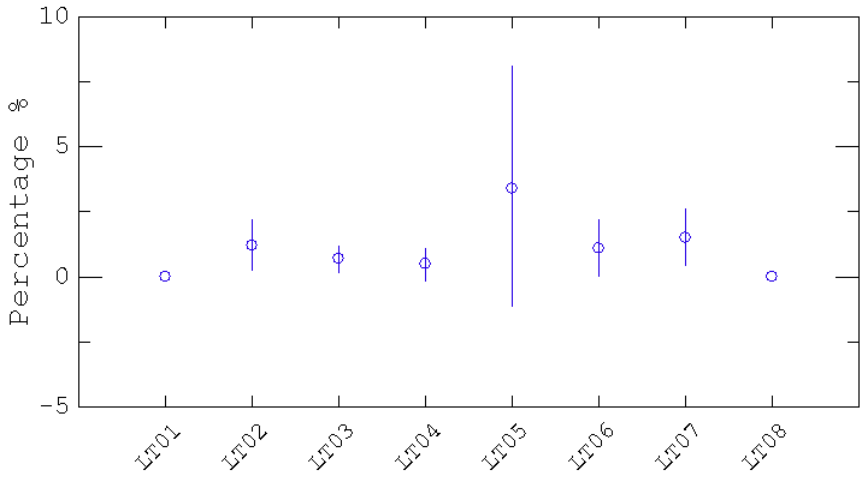

Figure 5.35 Proportions of Decorated sherds by lot, Late Catanga. Santa Juana.

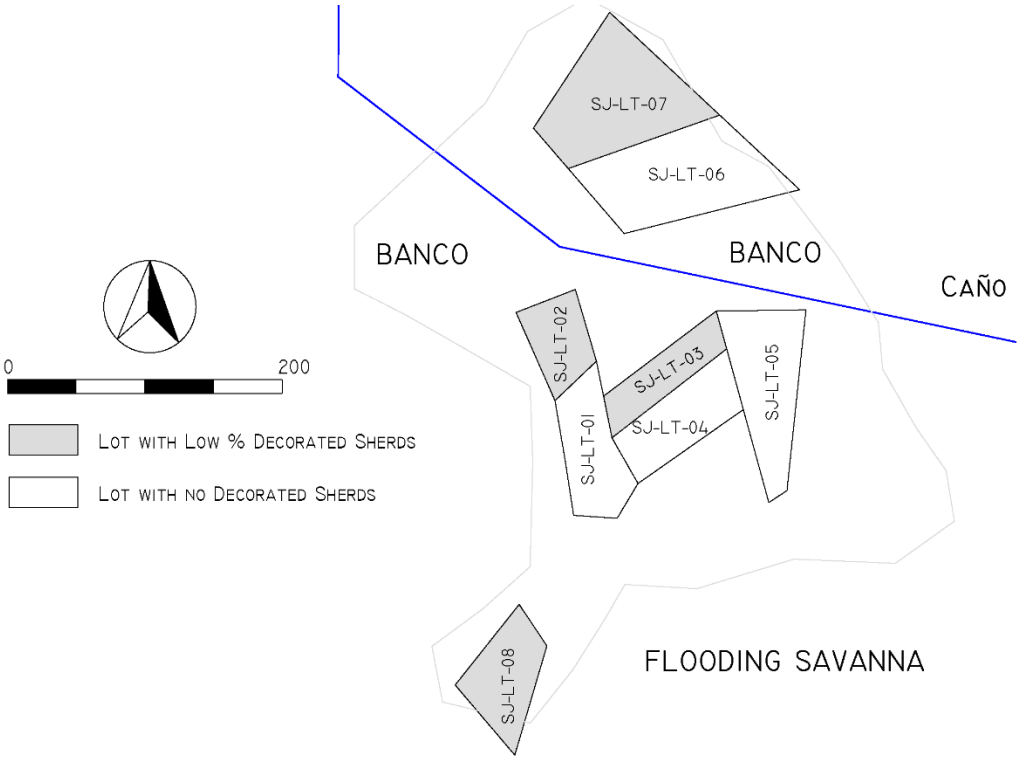

Figure 5.36 Collection lots with decorated sherds during Late Catanga period. Santa Juana.

To summarize, throughout the sequence there were lots in which decorated vessels were used. The presence of lots with no decorated vessels suggests that not all households participated in ceremonialism. If we consider that Santa Juana did not belong to the regional polity of Catanga, the tendency through time in the local communities of the Catanga polity shows that ceremonialism was more intensive in the latest occupation which contrasts with what was observed in Santa Juana. Probably at Santa Juana during the Late period, there was major emphasis on other activities such as exchange or warfare that produced centripetal forces that brought together more people than in previous periods.

5.7 LEADERSHIP AND CEREMONIALISM IN THE CATANGA REGION

The construction of sociopolitical leadership has been assumed many times to be a unified process that takes place homogenously at spatial and temporal scales. The archaeological evidence from the Catanga region suggests that the emergence of leadership was a process likely affected by demographic factors that determined different configurations of political relationships at the regional and local levels.

An important issue for the archaeology of Llanos societies is ceremonialism (Gassón 1998, 2009; Spencer and Redmond 2014). Gassón has argued that ceremonialism was a mechanism used by the prehispanic rulers in the Barinas region in direct relationship to the production of agricultural surpluses (Gassón 1998). His argument is that ceremonialism drove social consumption and created the necessity to increase agricultural production so as to fulfill the

requirements of the emergent rulers (Gassón 1998). He also has argued that, based on the formal-functional analysis of ceramics, ceremonialism occurred more frequently in the upper tiers of the regional settlement hierarchy during Late Gaván times in El Cedral region (Gassón 1998). Spencer and Redmond (2014) have recorded evidence that support this argument in El Gaván region, where the analysis of ceramics revealed a similar pattern of ceremonial activities occurring more frequently in the regional center. In addition, Spencer and Redmond (2014), suggest that in the case of El Gaván polity, it is possible to distinguish two contexts for ceremonialism: public and domestic. These authors argue that elites in the Llanos controlled and centralized ceremonialism. Both Gassón (1998) and Spencer and Redmond (1998, 2014) have been focused mainly on the analysis of the phenomenon at the regional scale, trying to demonstrate a connection between the emergence of a regional elite and the monopoly of ceremonial practices. Nevertheless, it is important to consider whether this tendency is just the final expression of changes that occurred at different scales since, for example, in Barinas feasting was more prominent in the regional centers. It is important to consider how this pattern was related with demographic factors.

Analysis of decorated sherds has revealed interesting patterns related to changes in ceremonialism, interaction and social differentiation within the local communities of the Catanga region. At least three different trajectories are identifiable in the archaeological record of this region related to the intra-site distribution of decorated ceramics:

- Trajectory 1: first, some areas have similar concentrations of decorated sherds and other areas have none at all. Through time and with the increase of population, from the Early

to the Middle period, there came to be sectors with varied concentrations of decorated ceramics as well as sectors without any decorated sherds at all. This tendency continues during the Late period. In settlements whit small residential mounds, major concentrations of decorated sherds were found. Catanga, Tilodirán and Corinto represent cases of this trajectory.

- Trajectory 2: first, some areas have similar concentrations of decorated sherds and other areas have none at all. Through time and with the increase of population, from the Early to the Middle period, there came to be sectors with varied concentrations of decorated ceramics as well as sectors without any decorated sherds at all. During the Late period, there are lots with similar low proportions and lots without decorated sherds. El Pensil and Santa Juana are good examples of this trajectory.
- Trajectory 3: At first, some areas had high proportions of decorated ceramics, other areas had lower proportions, and still other areas had no decorated ceramics. During the Middle period, this tendency continued but it changed in Late Catanga when there are lots with high proportions and lots with low proportions of decorated sherds. In the lots with high proportions, mounded structures were built. El Arenal represents well this third pathway.

The differences in these patterns of decorated ceramic distribution could express different strategies used by emergent elites in the region of Catanga. Johnson (1982) has emphasized the relationship between population and social-system complexity. The different patterns of distribution of decorated ceramics observed within settlements in the Catanga region could express the degree of influence that emergent elites were able to impose upon their

production and distribution contingent on the demographic scale of the group. The idea is that in groups with fast population growth, elites gained influence over ceremonialism based on their kinship prerogatives, while in groups of small demographic scale and slow population growth, the prerogatives over ceremonialism were in dispute based on household competition. Hence, it is possible that in the regional center, a monopoly over ceremonial activities was exercised by the local elite to reinforce their social influence through the manipulation of kinship and ideology, using feasting and impressive residential architecture, while at the same time restricting the use of valuable goods such as decorated ceramics by the rest of the population.

In the case of Catanga, during Early times, decorated sherds were concentrated in similar proportions in some occupied lots; however, it is possible to distinguish a cluster of lots that during the next two periods showed higher proportions of decorated ceramics. In this sector, residential architecture was also built. It is likely that the first settlers brought with them decorated vessels as a part of the Osoide tradition that extended across the Llanos of the Orinoco. With the passing of time, population grew and the original families continued the use of this central area and intensified ceremonial activity as indicated by higher proportions of decorated sherds during Middle times. Around the same time, close to the central area some other households also had access to decorated ceramics but in lower proportions. During the Middle period, decorated ceramics were absent in some peripheral lots, possibly indicating that the production and consumption of these artifacts were restricted. The families without decorated ceramics were perhaps distantly related by kinship to the founding families. Bentley (2003: 37); Netting (1993: 12) and Salzman (1999: 34) have argued that inequality has an age component because groups gain status and power as they get older. It seems that this process of

institutionalization of social inequality was advanced in the local community of Catanga by Late times.

The presence/absence of decorated ceramics in the local community of Catanga implies at least three alternatives: 1) the production and distribution of decorated vessels were under the direct control of families living in the central area of the settlement; 2) these vessels were obtained through a restricted exchange network controlled directly by those families; 3) or the families living in the central area were more focused on social prestige and put more effort into production or acquisition of possessions that gave them prestige or were used in ways that gave them prestige and with that came some degree of social influence over others in their local community and eventually in other local communities too. These patterns of differential distribution of decorated vessels intensified during Late Catanga times and apparently coincide with what was described by the Spaniards at their arrival: the existence of marked social differentiation expressed in the presence of elite and subservient families. In this case the headman of the largest kin group could be the headman of the village.

In the case of El Arenal, the distribution of decorated sherds suggests that from the beginning of the sequence most of the families used decorated vessels, although some of them had higher proportions than the others. During the Middle period, there was an increment in the proportions of decorated sherds within the site that probably coincided with the construction of two mounded residential structures. In the area where these residential structures were located, the concentration of decorated sherds remained higher than in the rest of the settlement. The demographic scale of El Arenal is smaller than Catanga (around 75-150 persons during the Late

Catanga period) which suggests that the process of social differentiation based on distant kinship was similar to that in Catanga. It is likely that the families in the community of El Arenal shared direct kinship ties and that social hierarchy was underdeveloped and limited by the demographic scale. In such a context, the intensification of ceremonialism allowed the emergent elites to compete for political recognition within the community. It seems that, although at the regional scale, leadership was consolidated, at the local level it was not. If decorated vessels were acquired through an exchange network, it seems that most of the families from El Arenal gained access to them.

In Catanga, with a population between 200-400 persons during the Late period, differences in wealth were more marked between the emergent rulers and their direct relatives and the rest of population because the vertical distance from the headman of the kin group to those not related directly to him was greater. When the vertical distance between leaders and followers increases, the frequency of transactions diminishes (Lewandowsky and Lisk 2013). Thus, those in a distant kin position enjoyed less interaction with higher ranking relatives as well as interaction that was different in nature. The scale of the group imposes restrictions on the way social interaction takes place because kinship is organized differently. Kinship is hierarchical in nature and in pre-state societies kinship is a fundamental principle structuring any kind of interaction. Lee has argued that "the kin-ordered societies are capable of accommodating a considerable degree of inequality" (Lee 1990: 240). During the Late period, El Arenal, Corinto, Tilodirán and El Pensil were inhabited by 75 -150 people, much less than the population of Catanga. In such a context, the scale of kinship structure was more limited than that of Catanga, and the vertical distance among the inhabitants of these villages was not so pronounced.

From this perspective, emergent rulers needed to interact more frequently with the rest of the population in order to create and reinforce their status. Building their factions depended on their capacity to attract more followers. If the size of the group is critical to the consolidation of the influence and power of the nascent rulers then they must ensure the benefits for the maximum of potential followers. As the power base is under dispute by other aspiring chiefs, it is expected that this situation benefits most of the population because every person is a potential connection in this network. In the archaeological record of El Arenal and Corinto, this situation could explain the generalized access and use of decorated vessels. In both cases, the size of the group precluded strongly marked status differences. Bentley has also argued that the degree of inequality is limited by the size of the group (Bentley 2003).

Analysis of the distribution of decorated sherds in the local communities of El Pensil and Santa Juana indicates that at the beginning, decorated vessels were concentrated in a specific sector of the settlement. When the population grew and the settlers expanded their occupation area, the use of decorated ceramics became generalized.

It is likely that El Pensil was an agrarian settlement, in which people settled in the northern part locating their households directly on the land that they farmed. It seems that this functional division was more evident in Middle times and it was consolidated during Late period when the maximum occupation was reached. In this context, household units could be engaged directly in the production of agricultural surpluses and tended to be self-sufficient. The surpluses generated in this way could support the intensification of ceremonialism at the family level. Although during the Middle period there was an area with a higher concentration of decorated ceramics, this

process of consolidation in the management of ritual activities at the local level was interrupted during Late times when all sectors of the community show similar concentrations of decorated vessels. The size of the local group of El Pensil could be one of the limiting factors that prevented the emergence of local leadership. Although the area of El Pensil during Late times is similar to the size of Catanga (around 12 ha) the population was smaller (El Pensil was inhabited by around 50 – 100 persons). In this demographic scenario, building a stable faction was a difficult for the emergent elite at El Pensil as it was at El Arenal. In the case of Santa Juana with a population of 76 – 150 people during the Late period, it seems that the consolidation of leadership was affected by similar demographic limitations.

Analysis of the distribution of decorated ceramics in the Catanga region reveals that they were concentrated differentially within the sites. This analysis assumes that elite involvement in ceremonial and feasting activities requires the use of large quantities of decorated ceramics for display that enhances prestige. Ceramic decoration has been recognized as related to the presence of aggrandizers (Clark and Blake 1994). Competition for prestige is a means to acquire recognition by potential supporters. The availability of resources and their productivity determine the levels of surplus accumulation that a group can generate and invest in social display and competition. Emerging elites can be directly involved in the production of agricultural surpluses or mobilize them from ascribed households (Saitta 1994). Household aging is an important factor in defining influence and authority within a community (Netting 1993). Family size affects the scale of production of a household, families with more productive members can accumulate more resources based on their own labor. As a consequence, larger families have

more chances to generate surpluses to invest in prestige competition (Clark and Blake 1994; Coontz and Henderson 1986).

The success of an aggrandizer depends on the capacity to offer the "most physical, social, and/or spiritual benefits to the most people on the most reliable basis. Thus, aggrandizers are strongly motivated to increase rewards through increased production and innovation" (Clark and Blake 1994: 21). The consumption of food is one of the mechanisms that have been associated with the emergence of social inequality (Dietler 2001; Hayden 1995). Competitive generosity based on food consumption offers opportunities for aggrandizers to acquire more followers and allies and to promote the growth of their own families (Clark and Blake 1994: 23). In the Catanga region, the differential concentration of decorated ceramics appearing together with high quantities of utilitarian ceramics, lithics and faunal remains in mounded areas suggests the involvement of some families in ceremonialism. The differential distribution of decorated ceramics reveals different patterns of consumption, probably caused by the differential involvement of the households in feasting as a result of kinship relationships and aging. If feasting was critical to the achievement of the emerging elites' goals at Catanga, then agricultural surpluses could provide the material basis to achieve them. In the case of El Cedral, Gassón (1998: 164) has argued that intensification of agricultural production was a result of the elite demands for surpluses. Polities engaged in feasting and warfare need more agricultural production, and thus it is not environmental stress that produce agricultural intensification but social competition.

In the archaeology of the Llanos of the Orinoco, researchers have been focused on the emergence of leadership at the regional level and they have assumed that this was a process that affects all communities similarly. What the Catanga archaeological record reveals is that demography is a central component in the process of leadership emergence at local and regional levels. In Catanga, ceremonialism could be under the direct control of the local elite through the mobilization of surpluses from the commoners' households to be invested in public ceremonialism or feasting activities. In other words, a more hierarchical structure in which the sociopolitical positions were more clearly defined emerged.

However, the process of social differentiation alternatively could be based on the activity of household units that through time participated in ceremonial networks and developed patron–client relationships. In this scenario, kinship was fundamental because stability of leadership depended on claims about connections with ancestors (or sanctification of power, Spencer 1998). In such a context, the older and traditional households could claim rights over feasting without opposition by the rest of the community. Older households can produce directly surpluses that can be redirected to finance alliances with other important families both within and between communities (Spencer 1993), but they also can mobilize surpluses from their followers' families. In this case, a less hierarchical social organization could emerge.

5.8 EXTERNAL EXCHANGE IN THE CATANGA REGION

The use of wealth by an emergent elite in ceremonial context has been described as a frequent practice among complex societies (Cobb 1996; Demarest and Conrad 1992; Grove and Gillespie 1992; Helms 1993; Langebaek 1991; McAnany and Wells 2008; Welch 1996). One of the main concerns of this research has been to test whether the regional and local rulers from the Catanga region established long-distance exchange with the neighboring Muisca chiefs from the Altiplano Cundiboyacense, as suggested by the ethnohistorical accounts. If this occurred then in elite activity areas, there will be imported artifacts. It is also possible that foreign raw materials could be imported by the elite and used to produce goods for widespread local use. As in the former case, imported raw materials would be accumulated in large quantities in elite activity areas.

Researchers on the Llanos have proposed that long-distance exchange was an important mechanism that the emergent elites in Casanare used to accumulate and consolidate their political power (Gassón 2002; Morey 1975; Spencer 1993, 1998). Spencer (1994) has argued that in the case of the Llanos of Barinas, chiefs practiced long-distance exchange with remote regions such as the Sierra Nevada de Santa Marta of Colombia and the high Colombian Andes based on the presence of a few ornamental artifacts made of exotic polished stones in the regional center of El Gaván. The amount of exotic artifacts recorded in the Llanos of Barinas is too limited to consider long-distance exchange as a critical mechanism used by emergent elites to expand their influence inside and outside of their own local communities, especially when the length of the occupation of the region is considered.

During the regional survey in the Catanga region, the evidence for long-distance exchange with the highlands of the Andes was scarce. The only clear evidence of contact with the Andes was a metal earring recovered at Catanga in test CA-CT-CE-07. There are four greenstone ornamental axes recovered at Catanga and El Arenal that likely came from the Andes. Although the evidence of long distance exchange is limited because the quantities of imported goods recovered are small, the intra-site survey registered substantial quantities of lithic tools and debitage made of chert, a raw material that is not available in the region. Chert sources are present in the piedmont at a distance around 20 to 30 km from the study area. Unlike ceramics lithics cannot be assigned to a defined period so, it is difficult to observe variation in their frequencies through time. Despite this, differential access to raw materials can be tested through the spatial analysis of the distribution of such materials. If access to chert was generalized it will be represented in similar proportions in the different sectors of settlements and in different settlements. The presence of cores in the record of the study area suggests that chert was imported to Catanga and probably to El Arenal as raw material and then processed locally.

5.8.1 Distribution of Lithics made of Imported Raw Materials in the Catanga Region.

In order to establish differences in the intensity of use of chert in the production of utilitarian goods within settlements, the concentration of cores was evaluated through the estimation of the proportions of lithic artifacts, cores and debitage made on chert and other imported raw materials. To do this, I collapsed those elements into just one category “lithics made on imported raw materials”. The analysis of distribution of imported lithic raw materials revealed an interesting spatial pattern.

In the local community of Catanga, it is possible to observe a differential distribution (Figure 5.37). Some lots had similar proportions of lithics made on imported raw material and others with none of these.

When the error ranges at 80% confidence level are considered, the main concentrations are located in the same lots with high concentrations of decorated sherds and where a mound structure was constructed. In contrast, lots entirely without lithics made on imported raw materials are in more peripheral locations. This distribution indicates that in Catanga, the area inhabited by the elite presented a greater accumulation of imported artifacts, debitage and cores, suggesting that families living there controlled access to imported raw materials in their community.

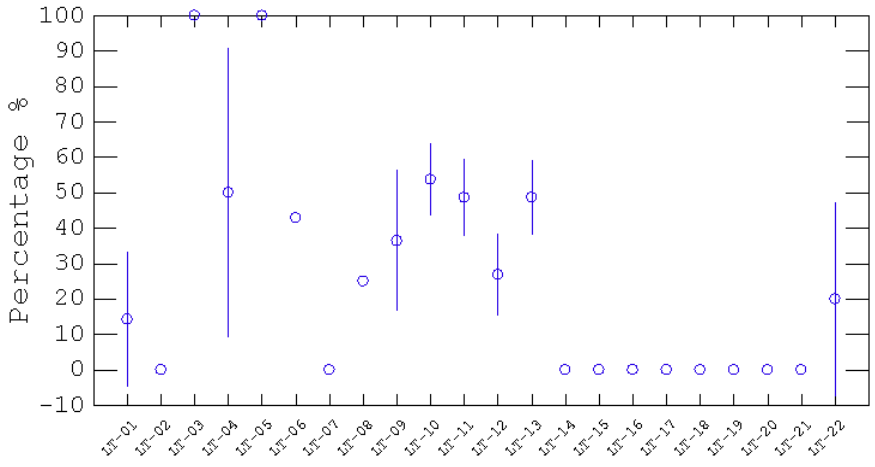

Figure 5.37 Proportions of lithic artifacts made of imported raw materials by lot. Catanga.

In the settlement of El Arenal, there are lots with high proportions of lithics made of imported raw materials, a lot with a low proportion, and lots in which there are no lithic artifacts

(Figure 5.38). The greater proportions of imported materials appear in lots where decorated ceramics were found in high proportions close to the mounds.

An interesting pattern appears when the spatial distribution of imported lithic raw materials is analyzed in the other communities of the region. Imported materials are present in just a few lots at each of these sites, such as Corinto, El Pensil and Tilodirán (Figures 5.39, 5.40 and 5.41). In the case of Corinto and El Pensil, it is likely that in lots with imported lithic raw materials, small habitational mounds were built between the Middle and Late periods that have been demolished in modern times. This pattern indicates that in these communities imported raw materials were used with less intensity than in Catanga or El Arenal.

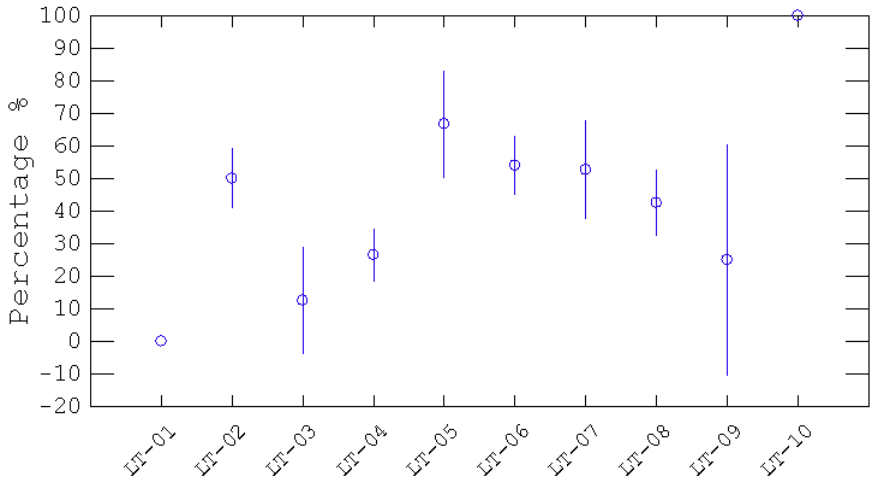

Figure 5.38 Proportions of lithic artifacts made of imported raw materials by lot. El Arenal.

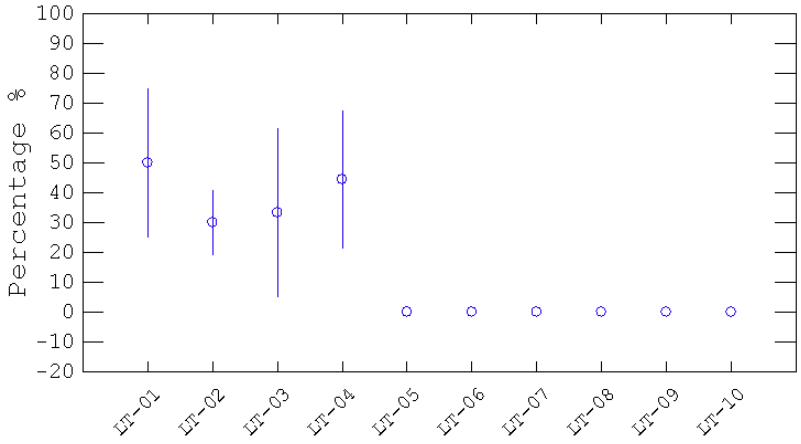

Figure 5.39 Proportions of lithic artifacts made of imported raw materials by lot. Corinto.

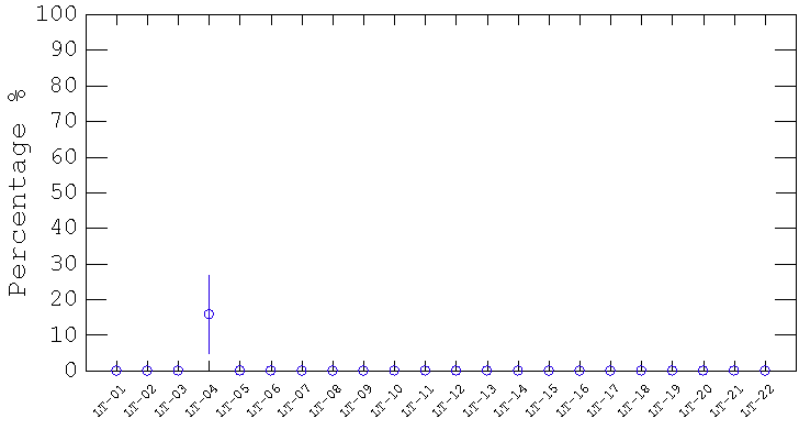

Figure 5.40 Proportions of lithic artifacts made of imported raw materials by lot. El Pensil.

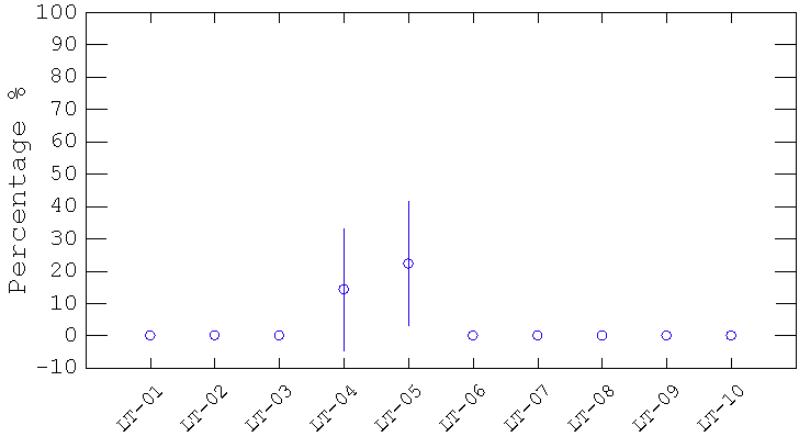

Figure 5.41 Proportions of lithic artifacts made of imported raw materials by lot. Tilodirán.

5.9 EXTERNAL EXCHANGE AND LEADERSHIP IN THE CATANGA REGION

Analysis of proportions suggests that the emergent elite from Catanga and probably from El Arenal controlled the flow of imported lithic raw materials to the region. Restricted access to foreign materials could be useful to the rulers of Catanga to develop and reinforce social differentiation within and between communities (Spencer 1993, 1994).

Despite the expectation derived from the Spanish colonial accounts about long-distance exchange relationships between the populations of the Llanos and the Muisca chiefdoms, the archaeological evidence of it was scarce; just a few metal and lithic ornamental artifacts recovered during the intra-site survey made in Catanga and El Arenal came to the region from the Andes. This small amount of imported artifacts from the Andes suggests that long-distance exchange between the Muisca and the Achagua was sporadic, and in consequence the flow of these artifacts does not represent an activity that emerging leaders could monopolize to finance and promote their political agendas. During more than fifty years, looters have not found tombs full of gold like in other archaeological regions such as the Altiplano Cundiboyacense, Malagana, the Sierra Nevada de Santa Marta, etc. If Casanare polities provided raw materials to the Muisca and received elite goods in exchange, tombs with fancy objects like gold ought to be found occasionally; however, that has not happened so far.

In contrast, it seems that middle-distance exchange of chert with neighboring piedmont communities was an important activity for aspiring chiefs of the Llanos. In archaeological sites such as Catanga and El Arenal, cores and lithic tools made on imported raw materials were recovered in areas probably associated with emerging elites, while in other sectors of these

settlements they were present in smaller proportions or absent. In other small local communities, chert cores and artifacts also are associated with elite areas. The evidence suggests that chert was used by the elite to produce utilitarian artifacts and not for ornamental goods. It will be interesting in the future to determine whether the utilitarian goods made on imported raw materials like chert were produced by the elite themselves or if they were produced by attached specialists, or if the emergent regional rulers of Catanga and/or El Arenal just provided chert as a raw material to be processed by the local chiefs in the smaller communities. So far, the evidence suggests the last of these alternatives because in all localities with chert artifacts there were cores and debitage, suggesting local manufacture of lithic tools made of chert.

In sum, elites from Catanga (and also probably from El Arenal) were engaged in the external exchange at relatively short distances of imported stone raw materials to supply their own people and as a way of providing benefits to their supporters and regional allies. It is likely that piedmont communities exchanged chert cores for polychrome ceramics from communities in the Llanos. The scarce available data from the piedmont suggests the presence of few Osoide and Caño Caroní sherds very similar to those excavated in the Catanga region (Rodriguez and Bernal 2013).

6.0 WARFARE IN THE LLANOS OF CASANARE

Although for northern South America it has been proposed that warfare was an important mechanism that elites used to promote their authority and the institutionalization of their leadership during precolonial times, the evaluation of the available evidence is still not systematic (Gassón 2009; Goes Neves 2009; Mora 2006; Redmond *et al.* 1999; Spencer 1993, 1994; Whitehead 1994; Redmond 2002; Vargas 2015). For that reason, warfare in the Llanos is evaluated here in comparative perspective. Four variables are assessed: population aggregation and buffer zones, territorial size of the political units, defensibility of agricultural facilities and settlement defensibility. As Elliot (2005) has pointed out conflict can occur at different scales and the evaluation of its presence/absence in the settlement patterns of a region needs to rely on more than one variable.

6.1. POPULATION AGGREGATION AND BUFFER ZONES

Warfare can cause the aggregation of population as a measure for reducing risk (Allen 2008; Dye 2006; Earle 1997; Junker 1999; LeBlanc 2006). The spatial proximity of different communities and

their members is a good strategy for the effective defense of the settlements in a region because it allows the rapid mobilization of people in a short time.

In the Llanos of Casanare there were two potential hazards according to the Spanish accounts. On the one hand, it is likely that hostile neighboring polities with populations similar to but somewhat larger than that of Catanga tried to capture people to increase their own available labor forces. Warfare of this sort is described by Spanish Conquest period sources as the mode in which political power and the extraction of surplus were negotiated among the Arawak groups in the Llanos of Casanare and Barinas. On the other hand, chroniclers and ethnographic sources report the presence of mobile hunter-gather groups of different ethnic affiliations in the Llanos of Casanare such as the Guahibo and the Saliva (Morey 1975). Those mobile groups are known by their bellicosity in obtaining resources. Conquest period sources describe how the Guahibo laid siege to the Achagua villages to obtain agricultural products during the harvest season (Morey 1975). Under such conditions, the aggregation of population could be a good strategy to defend the settlements and territory. From the Llanos of Barinas, we know that there were different strategies of aggregation of population among the polities. In some cases, such as in the El Cedral region, people could be concentrated in a large settlement surrounded by wide empty areas (Gassón 1998). In this case, the size of the population served to dissuade any attack (LeBlanc 2006). In other cases, such as in the El Gaván region, people could be aggregated in a large nucleated village accompanied by small and less densely nucleated villages through the political territory (Spencer and Redmond 2007). It seems that this last was the strategy used by the prehispanic population in the Catanga region.

The archaeological evidence supports the argument that in the region of Catanga, there was a clustering of settlements at the regional scale and that this cluster got tighter or looser through time as indicated by the demographic centralization analysis. Archaeologists propose that in the Llanos warfare initiated the centralization of population and the emergence of regional centers, and subsequently, the establishment of alliances that allowed the consolidation and expansion of polities (chiefdoms), the emergence of new decision-making levels and the eventual consolidation of a regional authority (Spencer 1993, 1998, Redmond *et al.* 1999).

It is very likely that this pattern of centralized distribution of population allowed the rapid mobilization of military forces between villages to organize the defense of territory, local communities and farming areas. Demographic centralization also offers advantages for exerting control and authority over dependent villages. In the case of the Catanga region, the small distance between settlements suggests constant interaction, probably on a daily basis. In the Early period, a small population preferred to locate their houses close to each other. Although there were some people living farther away, the average distance between local communities (r_o = 762 m). During the next two periods, the trend toward demographic centralization diminished while there was a significant increase in the population. Although settlements tend to be more separated, the distance between them remains moderate (around 1 km).

The regional survey recorded large areas of bancos where it was possible to locate new settlements; however, people in the region chose to live close together in relatively reduced areas and did not occupy these other available zones. It is just during the Late period when there was a discrete peopling of new small areas. During the Middle period, the consolidation of the

main nucleated village of Catanga took place and in the Late period other villages such as El Arenal, Corinto, El Pensil, and Tilodirán also were consolidated. The dates obtained in Catanga suggest that at least for 600 years these villages were occupied permanently. In this case, the demographic strategy displayed by these communities seemed effective for ensuring the reproduction of the social units.

The analysis of demographic centralization suggests that since Early times, the Catanga polity was increasing its territory. It seems that outside of the study area, there are more settlements like those recorded in the Catanga region. If so, it is likely that other polities around Catanga were also in an expansionist process as described by the chroniclers (Morey 1975). In this scenario, the nucleation of population and the close spacing of settlements observed in the Catanga region could be a good strategy for the regional and local elites to ensure the survival and consolidation of the regional center and the small local communities attached to it, and at the same time, the defense and control of the entire territory.

It is also important to consider nucleation at a local scale. In sites, such as Catanga, El Arenal, Corinto, Tilodirán and Santa Juana people chose to live close to their neighbors. Although these sites were located on large and broad bancos, the slight increase of the occupied area together with the considerable population growth suggest that despite having enough space to expand the area of the settlements, people preferred to stay close together. The only community in which people decided to remain dispersed within the occupied area was El Pensil. In this site, the low densities of ceramic materials suggest that the population remained low. While during the Late Catanga times, the local community of Catanga was inhabited by 300 people in an area

of 13 ha approximately (23 persons/ha), the local community of El Pensil had around 100 persons in 12 ha (8 persons/ha). This dispersed pattern could be related with agricultural practices because in El Pensil, archaeological materials are associated with farming facilities such as small mounds and terraces. This pattern of population distribution at El Pensil suggests that if warfare was present in the region its intensity was low enough that it was not a major concern when people decide where to locate their households.

The demographic centralization analyses indicate that there were large empty areas around the Catanga polity which was the result of people's tendency to live in aggregated nucleated villages. Similar areas have been recorded in the Llanos of Barinas and Gassón (1998) has argued that they acted as buffer zones among polities. This distribution supports what was observed by the chroniclers. For instance, Rivero (1956) pointed out that these fortified villages could be separated by 6-7 km of empty area.

In the archaeological literature, the presence of buffer zones is an indicator of warfare (Allen 1994; LeBlanc 2006; Marcus and Flannery 1996). These depopulated or underpopulated areas serve to define the borders between polities' territories (Anderson 1994). Buffer zones are also important in terms of the defensibility of territory and subsistence production. They prevent the destruction of crops and serve as an early warning system against surprise attacks and also to reduce the opportunity for disputes to arise (LeBlanc 2006). Anderson (1994) has related the presence of buffer zones with small-scale warfare which is a method used by chiefly societies to maintain territories and boundaries. Small-scale warfare affects regional settlement distribution, hunting patterns, and other resource procurement activities (Anderson 1994). In the Llanos of

Casanare, it seems this was the kind of warfare practiced by the indigenous communities. There are only scarce reports in which intensive warfare was directed to extermination and annihilation (Rivero 1956). Small-scale warfare is characterized by small parties engaging in confrontation, ambushes and raids. Anderson (1994) argues that it occurs when task groups go far away from villages and encounter small groups from other polities. A direct result of a regional pattern of low-intensity warfare would be that group boundaries would come to be defined by the unoccupied zones between polities that were only infrequently visited. An ecological consequence was that buffer zones served as prey reservoirs in which game animal populations depleted closer to settlements might replenish themselves. The maintenance of buffer zones, whether intentional or not, helped these societies avoid potential resource shortages (Anderson 1994: 40).

Because of warfare and conflict large amounts of farmland are taken out of production (Arkush, personal communication 2014). These areas of empty farm land have been recognized by archaeologist as a criterion of buffer zones. In the case of the Llanos, Morey (1975), Morey and Marwitt (1978) and Spencer (1994, 1998) have argued that the scarcity of good land for cultivation was the main cause for warfare and that this context of scarcity and circumscription produced environmental population pressure. If this is the case, then buffer zones including significant amounts of farm land and would increase the imbalance between population and resources, making the problem worst. By now, archaeological evidence has demonstrated that although several regions in the Llanos of Barinas and Casanare were densely occupied there was no pressure on agricultural resources, and that although farm land was limited it was sufficient to support the regional population (Gassón 1998; Vargas 2012).

In the Catanga region most of the soils are of low productivity which means that empty zones do not necessarily include good farm land. Although agriculture in the Llanos is the main economic pursuit, other economic and subsistence activities were carried out by local groups in the different landscape units that make up a polity's territory. Agricultural productivity is thus not the exclusive criterion of the economic value of the land in a political buffer zone. Indeed, it is possible that in the Llanos even landscape units with soils of poor agricultural productivity were rich in raw materials, hunting and fishing. In addition, soils could be modified through raised field agriculture. Thus, the presence of land of high agricultural productivity would be an observation tending to confirm a sparsely occupied zone as a politically motivated buffer zone. Sparsely occupied unproductive farm land, however, could amount to forsaken economic opportunity of other kinds in buffer zones between the different polities in the Llanos in prehispanic times.

Unfortunately, the available archaeological information for Casanare it is not enough to evaluate the existence and extent of buffer zones because to do this it is necessary to identify and study at least one neighboring polity and the survey zone includes only the Catanga polity. It is possible that the small settlement of Santa Juana belongs to another polity, but it is also possible that it was simply an independent village trying to colonize an environment of flooding savannas. In the Llanos of Barinas, the available information about the neighboring regions of El Cedral and El Gaván suggests broad areas of empty land which would be considered a buffer zone (Redmond *et al.* 1999; Gassón and Rey 2006; Vargas 2015).

In sum, the nucleated distribution of population is consistent with the argument that warfare and conflict were present in the region. Despite this, the absence of archaeological

information for neighboring regions makes it impossible to know whether the polity of Catanga was separated from similar neighboring polities by buffer zones. In addition, factors such as the organization of agricultural production or feasting could act as centripetal forces which attracted people and produced nucleated patterns rather than warfare and violent conflict.

6.2 POLITY SIZE

Attention to the scales at which community structures of interaction form is fundamental to the comparative study of complex societies (Peterson and Drennan 2005: 6). Peterson and Drennan have suggested that larger and more densely occupied sites would dominate larger territories than smaller ones would (Peterson and Drennan 2005: 19). Asymmetries in demographic and spatial terms are important among groups or polities engaged in violent confrontation (LeBlanc 2006). The chroniclers in the Llanos have suggested that different ethnic groups of different scales were engaged in warfare at the time of the Spaniards' arrival (Morey 1975).

The archaeological record of Barinas indicates that polity size in the Llanos was highly variable. For instance, the Catanga polity during the Late period was inhabited by no more than 1000 people distributed in a territory of approximately 150 km^2. The polity of El Gaván during the Late Gaván phase had a territory around 490 km^2 with a population of about 3000 people. During this same period, it is likely that the polity of El Cedral occupied a territory around 760 km^2 with a population estimated at more than 5000 people (Vargas 2012). These estimates suggest that during precolonial times, in the Llanos of the Orinoco, there were polities of different sizes with

different degrees and levels of social interaction and integration. These differences are critical to the political aspirations of rulers. A small polity cannot expand due to its demographic limitations because it is disadvantaged against its larger neighbors (LeBlanc 2006). These limitations are not just related to the size of fighting force but to the potential of each polity to produce surpluses to invest in warfare (LeBlanc 2006). A larger polity can produce more surpluses to support its warriors. A small polity can seek to overcome this disadvantage and produce more surpluses if it has especially productive farmland or by developing more productive agricultural technology. A small polity with a high potential for intensification could be able to conquer larger polities if it develops good military leadership, skills and military technologies based on the investment of surpluses (LeBlanc 2006).

The integration of polities of the size of El Cedral could be an example of the expansionist warfare of the Arawak groups, described by the Spaniards during their invasion, based on capturing labor force and farm land (Morey 1975). Redmond *et al*. (1999) has argued that the collapse of El Gaván Polity around 1000 A.D. was a consequence of an attack carried out by the armies of El Cedral polity as part of an expansionist effort. This could be a case in which a large polity with a major capacity to produce surpluses conquered or destroyed a small polity. This case agrees with LeBlanc's (2006) proposal about asymmetry as a determinant factor in warfare.

It is likely that in the Llanos of Casanare there were other polities similar to that of Catanga during prehispanic times. The site of Santa Juana may belong to one of them. If Catanga was the largest polity in Casanare it could help to explain why it has no enclosure or palisades because the absence of those structures could be indicative of its strength (Anderson 1994: 100). Such a

possibility can only be assessed by extending regional survey to a larger area to establish whether neighboring polities exceeded the demographic and territorial size of the Catanga polity.

6.3 DEFENSIBILITY OF AGRICULTURAL FACILITIES

Agricultural facilities must be protected during violent incursions (Allen 2006; Anderson 1994; LeBlanc 2006). The destruction and looting of agricultural fields is a serious hazard for the survival of the group and can produce the collapse of a polity under attack. Some effects of the destruction of farming plots could be famine and the reduction and disintegration of armies if supply flows are interrupted. The construction of raised fields implies the investment of considerable amounts of labor and resources which produce landesque capital through time. Anderson (1994) suggests for the Mississippi area that the "investment in facilities, such as cleared agricultural fields, is also thought to have prompted the aggressive defense of these areas". In the Llanos people may also have organized themselves to protect agricultural facilities threatened by mobile groups and other polities. In some regions, such as New Zealand and the Philippines, storage technology, fortifications and temporary refuges have been developed as strategies to deal with violence and bring security to the local inhabitants (Allen 2006; Earle 1994; Junker 1999). In these cases, the need for protecting stored agricultural products and controlling access to favorable locations was critical to the survival of these societies. The need for protection also has effects on social organization because it creates opportunities for some individuals to

direct and control the implementation of these strategies thus fostering the development of dependent relationships.

In the Catanga region, it seems that the defense of agricultural facilities and crops was facilitated by the distribution of the raised fields between local communities. As discussed above, the extent, dispersion and fragmentation of raised fields in Catanga could be explained by the agroecological conditions in the region. However, the distribution of raised fields in relation to the distribution of local communities was also optimal in terms of the defensibility of the agricultural facilities because their location made possible the rapid mobilization of defensive forces from the villages.

Raised fields were generally located less than 3 km from villages, a distance that can be reached walking in less than 20 minutes in the savannas. The European chroniclers report that agricultural fields were under siege seasonally (Morey 1975). The defense of agricultural facilities could be carried out in the same way as village defense by quickly mobilizing people from different localities.

In sum, it seems that since the beginning of settlement of the area around 1000 A.D., agricultural production was affected by such factors as the distribution of labor force, soil drainage conditions and need for fallowing in the region of Catanga. However, it seems that this pattern of distribution was also efficient for the defense of the agricultural facilities. The evidence suggests potential for conflict in the region; however, it seems that its intensity and incidence was very low. If high-intensity warfare were endemic, it would be expected that people would locate their raised fields immediately adjacent to their settlements, as occurs in El Cedral region.

This would be a good strategy not only for regional and local elites to protect the agricultural facilities but also for controlling directly agricultural production. The archaeological evidence in the Catanga region, however, does not support a scenario of such intensive warfare

6.4 DEFENSIBILITY OF SETTLEMENTS

The archaeological literature has noted several alternative strategies that communities can pursue for their own defense. Some authors (Allen 2006; Anderson 1994; Elliot 2005; Junker 1999; Webster 2000) have pointed out that the location of sites in areas of difficult access is strategic for small groups seeking to avoid attack. In the highlands, people can locate their settlements on hilltops to enhance visibility and defensibility (Allen 2006; Anderson 1994; Arkush 2006; Earle 1997; Elliot 2005; Junker 1999; LeBlanc 2006). Obviously, this is not a strategy that can be implemented in the flat savannas. However, it seems that in the Llanos people chose some locations on the elevated bancos that favored defensibility because of the increased visibility of the surrounding territory while making difficult the observation from the savannas and bajíos. In addition, the vegetation of these locations, composed of palms, small trees, thorn bushes, among other plants, hinders accessibility to the site (Figures 6.1 and 6.2).

The location of sites on the bluffs of the secondary streams makes it easy to create such obstacles as wood barricades to impede intrusions. Currently, the colonos build such obstacles at the mouths of the caños to prevent cattle from crossing the borders between haciendas. Watchtowers made of organic materials could also serve as a low-cost defense strategy. Elliot

(2006) suggests that in regions in which the settlements forms a network (as they do in the Catanga region) inhabitants can send signals to one another with torches, rapidly warning the main settlement of danger, even over a great distance. In the Llanos, this system was used until few years ago among cowboys to prevent the theft of cattle.

Figure 6.1 Panoramic view over El Arenal archaeological site.

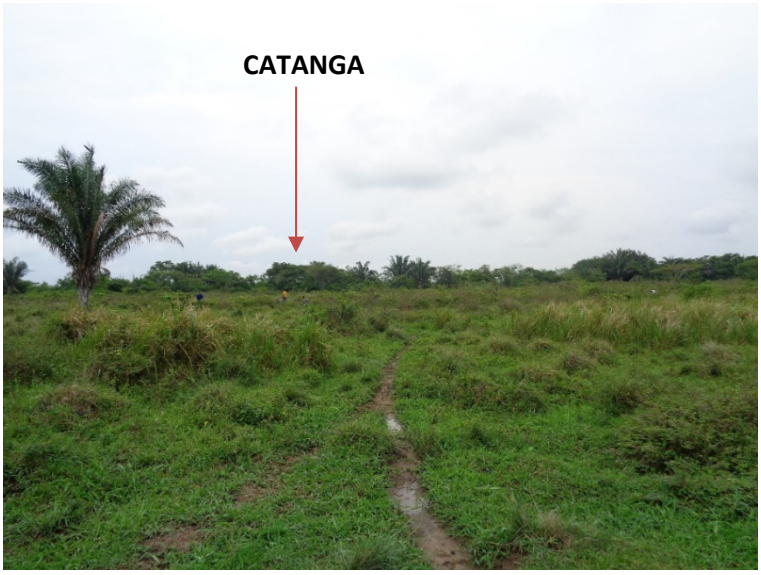

Figure 6.2 Panoramic view over Catanga archaeological site.

The construction of fortifications and enclosures could be considered a high-cost strategy (Allen 2008; Anderson 1994; Dye 2006; Elliot 2005; Junker 1999; LeBlanc 2006). No evidence of palisades or enclosures similar to those of Barinas was encountered in the Catanga region. Dye (2006) has argued that the palisade at the site of Moundville was removed and replaced around 1300 A.D. in the absence of nearby competitors. If Catanga was the most populous and powerful polity in Casanare, the absence of strong competitors would explain why fortifications were not constructed. The absence of enclosures and other forms of defensive structures similar to those reported in Barinas suggests that if warfare was present in the region, its intensity was low and probably the complex societies in Casanare were less involved in warfare.

One of the goals of this research has been to establish if warfare was an important factor in the emergence of leadership. The archaeological evidence collected in Catanga is not entirely conclusive, but it does suggest that whatever conflict and warfare may have existed was not endemic, frequent, and intensive. At least warfare was a less important facet of life in Casanare than in Barinas. Nucleation of population and the location of villages on bancos with good visibility suggest that violence could be present in the region. The distribution of raised fields also suggests that defense could be a criterion that people considered when deciding where to locate them. In general, it seems that the inhabitants preferred to stay relatively close to their raised fields but not immediately adjacent to them as at El Cedral. The locations of settlements offered some advantages for their defense. On the other hand, the absence of palisades or earthen defensive structures and the permanence of villages in the same locations through time suggest that warfare was a phenomenon of small scale and low intensity. In the absence of additional information about the surrounding regions it is impossible at this point to evaluate the presence

of buffer zones and the impact that polity size could have for conflict. It is also important to consider how other factors such as agriculture and feasting could have been related to the aggregation of population.

7.0 CONCLUSIONS

This research has proposed to investigate the different choices that the leaders of prehispanic Casanare communities had at their disposal and the impact of their decisions on the development of social complexity in the region. To compare the trajectories of change that led to the chiefly societies of the Llanos of Casanare and Barinas, the proposed research has been focused on selected aspects of the archaeological record from those regions such as agricultural intensification, warfare, exchange, feasting and monumentality, which I will discuss briefly in this last chapter.

The archaeological evidence recovered during the regional survey carried out in the Catanga region suggests that the polities from Casanare were smaller in spatial and demographic scale than in Barinas. The information about the Barinas polities of the Late Gaván period suggests that a radial distance of 12.5 km (490 km^2) is a good measure of the territorial extent of the polities. In some cases, such as El Cedral polity the territorial size could reach 600 km^2. In Casanare the supra-local communities of the Early, Middle and Late Catanga periods do not exceed 200 km^2.

The differences in the extent of the chiefly territory and in the size of the regional centers are the expression of the different demographic backgrounds of each polity. In the case of Barinas during the Late Gaván times, around 4000 - 6000 people composed the regional population of El

Cedral chiefdom while approximately 2000 – 3000 persons integrated the El Gaván polity (Vargas 2011, 2012). On the other hand, the population of the entire region of Catanga did not exceed 1000 persons during the Late period, the moment in which this polity experienced its demographic maximum.

The analysis of demographic centralization carried out in these three regions indicates differences between the regions. In the case of Barinas these values are only available for the Late period. The *B* index value for El Cedral was 0.1 and for El Gaván 0.44 (Vargas 2013). For the Catanga region the centralization *B* index was 0.83 for the Early period, 0.73 for the Middle period and 0.68 for the Late period. Despite the low centralization index the polity of El Cedral, the largest in size, was integrated strongly, as indicated by the causeway network that connects the small rural settlements and the small nucleated villages with the regional center, even though remained decentralized in demographic terms. Although the nucleation of population is characteristic in this region, the territorial extent of this huge polity produces a demographically decentralized pattern. The *B* value obtained for El Gaván polity indicates a moderate centralization related to the primary center. This observation is supported by the central place analysis made by Gassón that indicates that in this region, the economic centralization was moderate and that the mobilization of resources apparently was not the main cause of the settlement distribution (Gassón 1997). As in the case of El Cedral, the presence of causeways that connect the regional center to secondary mound centers suggests that the communities of the region probably were highly integrated.

Construction on a monumental scale also indicates an intense integration of the communities in Barinas during Late Gaván times. In the case of the Catanga polity, the *B* index diminishes through time as an effect of the population increase at smaller outlying sites. It is striking that the location of the nucleated settlements was very stable through the entire sequence of occupation. Once the initial settling families were established on the large bancos their descents remained in the same places.

In Barinas, the emergence of supra-local communities or polities took place during Late Gaván (550–1000 A.D.) times, and presumably near the beginning of this period after at least 700 years of occupation (Spencer 1998). The evidence collected in the Catanga region indicates that the emergence of supra-local communities occurred from the beginning of the occupation around 1000 A.D., during the Early Catanga period when some families arrived and distributed themselves in small farmsteads around the small village of Catanga. During the Middle Catanga and the Late Catanga periods population increased and the initial settlements became nucleated villages gravitating around the larger and densely nucleated village of Catanga. Thus, the process of emergence of the Catanga polity took less time than in Barinas.

Evidence of specialized craft production and long-distance exchange between the Casanare populations and the Muisca of the Andes is scarce. The regional survey just recovered a few ornamental artifacts including a metal earing and some greenstone axes that probably came from the Andes suggesting that the intensity of exchange was very low. In the Catanga region there were, however, lithic artifacts made on chert that represented middle-distance exchange with the local communities or polities of the piedmont, a modest distance away. It

seems that chert was imported to the region in the form of cores by the Catanga chiefs and then manufactured locally by the secondary elites living in the small nucleated villages. There is an association of chert tools and debitage with residential mounds in the regional center of Catanga and in El Arenal. Substantial quantities of decorated sherds were also recovered near these mounds, suggesting that they were elite activity areas. It is likely that Catanga exchanged its own polychrome ceramics with the piedmont communities that provided chert. The exchange of chert seems of much greater importance to the aspiring elites in the Catanga polity than connections with Muisca chiefs in the highlands. Chert was probably used by Catanga elites to represent authority and ability to establish external contacts thus reinforcing social differences between themselves and secondary elites and the rest of the regional population.

The cluster of occupation that represents the Catanga supra-local community and the analysis of demographic centralization show large empty areas around the Catanga polity which is a result of the tendency to live in nucleated villages spaced relatively close together. Similar areas have been recorded in the Llanos of Barinas and Gassón (1998) has argued that they acted as buffer zones between polities. The extent of the regional survey in Casanare does not allow us to determine whether there were polities similar to Catanga in neighboring regions. The nucleated village of Santa Juana could be part of one of these other polities. Close to the surveyed region, there are archaeological sites that suggest such neighboring polities.

The absence of enclosures or palisades similar to those recorded in Barinas suggests that warfare was not so intense in Catanga. The absence of palisades could also indicate that Catanga

was by far the largest polity in the region, and that its demographic scale could dissuade potential enemies, making the construction of large defensive structures unnecessary.

Altogether the evidence suggests that in contrast to the Barinas complex societies, in the Catanga region warfare was not a main factor that affected the emergence of central leadership or its consolidation at least during the first stages of the occupational sequence. It is also possible that the demographic growth experienced during the Late Catanga period could have brought intra-polity conflict. The stable locations and steady growth of all communities in the Late period, however, is not consistent with the presence of much conflict and warfare between them, which should have produced more demographic and locational flux.

The analysis of decorated ceramics distribution indicates that ceremonialism probably was an important strategy used by the elites of the Catanga polity. In the case of the regional center of Catanga, high proportions of decorated sherds were associated with areas where small habitational mounds were built. These ceramics appeared accompanied by high proportions of faunal bones and charcoal. In contrast, there were sectors in this village in which decorated ceramics were absent. This distribution suggests that the local elite was manipulating ceremonial and feasting activities as a strategy to enhance their influence and authority. In some small villages, such as El Arenal, decorated ceramics were more evenly distributed although they were also concentrated in residential mounds which probably indicates that local emergent elites were engaged in feasting competition.

The archaeological evidence in Catanga supports the idea that feasting was a strategy used by the emerging rulers in the larger communities in a similar way to what occurred in

Barinas. Feasting would be an effective way in these small communities to mobilize surpluses from the household level toward the community level through the participation of most of the people in every village who probably enjoyed the benefits derived from the recurrent performance of public and private ceremonies. In these ceremonial contexts, emerging chiefs could use their influence to mobilize surpluses from their own farming fields as well as from the fields of their allies. On other occasions, feasting could involve only a few elite families living in the central area of the settlements in which they invested their own surpluses as a way to promote their political alliances with other important groups and individuals from their own community or from neighboring allied villages. The scale of the group that was involved in feasting determines the amount of resources and labor that were invested in the occasion. Dietler has recognized the importance of feasting to create and maintain social relationships among different groups and networks "on a wide range of scales, from the local household cluster to the regional political community" (Dietler 2001: 69). In the case of Catanga, the distribution of decorated ceramics within the archaeological sites suggests a differential involvement of the household units in the performance of feasts.

The analysis of the ceramic artifacts poses suggests the possibility that the first inhabitants of the Catanga region came from Barinas around 1000 A.D., after of the collapse of the polities of El Gaván and El Cedral around 900 A.D. Barinas and Casanare are linked through navigable rivers such as the Anaro, Apure, Meta, Arauca, Cravo Sur and Casanare; thus, movement by water could reduce distance considerably. It would be easy, then, after the collapse of the Barinas chiefdoms from adverse climatic conditions or violent conflict around 900 A.D., for some families to migrate toward other regions in the Llanos of the Orinoco looking for better

climatic and social conditions. Once these families were established in habitats similar to those they came from and in the absence of violent conflict or intense climatic fluctuation, in just few centuries those initial small groups could reach the demographic scale necessary to develop complex social organization. The presence in the Catanga region of Osoide and Caño Caroní ceramics originally associated with the Llanos of Barinas supports this hypothesis.

It seems that the image of the Barinas chiefdoms in which strong, dominant and exploitative leaders developed agricultural intensification to produce large surpluses (Spencer 1993, 1994; Spencer and Redmond 1998) does not represent well the societies from the Llanos of Casanare. It is very likely that because of the small demographic scale of the Catanga polity, its capacity to produce and mobilize surpluses was constrained and limited the development of a large-scale economy similar to that of the Barinas chiefdoms. The larger populations and more hierarchical organization of Barinas have made it possible for the elites in Barinas to mobilize and appropriate larger agricultural surpluses based on the intensive farming system, to finance more ambitious political and ideological activities such as the construction of monumental architecture, long-distance exchange and warfare (Spencer 1994). In contrast, in a regional setting such as Catanga, in which the population was small in comparison to the Barinas polities, it is likely that a less hierarchical organization had emerged. Johnson (1982) has argued that there is a relationship between population size and organization of production. The demographic and organizational features of the Casanare communities probably constrained the production and mobilization of surpluses that the emerging rulers could dispose to promote their political aims. It is likely that under a production regime such as that implemented by the Bari communities in modern times, the inhabitants from Catanga in the past could have experienced constraints

related to the available labor force for intensifying agricultural production to obtain greater surpluses. Whitehead (1994), Drennan (1996) and Gassón (1998) agree that the critical element in the Llanos for farming was labor force not land. Under these circumstances, the spectrum of political strategies available to emergent rulers of Catanga local communities for developing and consolidating their leadership, could have been limited to the manipulation of the kinship network and to activities such as feasts and external exchange that did not require the investment of large amounts of surpluses and could be performed by a family. In the Catanga region, agricultural labor could be organized at the household level or based on the participation of a few families in a local community. If so, it is likely that the elite families were involved directly in the production, mobilization and appropriation of surpluses. This is an image that contrasts with the model proposed by Spencer (1993, 1994) for the Barinas chiefdoms.

In sum, it seems that the emergence of leadership in the Llanos of Casanare was a small-scale process based on the production and accumulation of agricultural surpluses, ceremonialism and middle-distance exchange at the level of the individual household. The archaeological evidence recovered in Casanare indicates social differentiation but considerably weaker than that seen in many other regions around the world. The implementation of agricultural systems such as raised fields, was probably related to the emergence of an incipient elite trying to transform the local and regional economic and sociopolitical context in which they acted. However, this process was less developed than in other regions of northern South America such as Barinas, the Altiplano Cundiboyacense, the Sierra Nevada de Santa Marta, the Guayas Basin, or the Depresión Momposina, among others. Possibly, this was a consequence of the limited political power that emergent rulers in Casanare could exert over their own communities.

The archaeological models proposed by Spencer (1993, 1994, 1998), Spencer and Redmond (1992, 1998), Gassón (1998), and Redmond *et al.* (1999) suggest that emerging elites or aggrandizers in Barinas appropriated surpluses directly from the producers. To do this, elites used coercive or ideological mechanisms expressed in warrior statuses, ceremonialism or sanctification of power. In their model, elites did not produce surpluses directly, they were separated from production; the appropriation was based on exploitative relationships. In Casanare, it is likely that the production and appropriation of surpluses took place at the household level. This is suggested because of the distribution of agricultural facilities, the distribution of archaeological remains, the absence of monumental construction, and the small regional and local demographic scale. Thus, emerging elites in the Catanga region could be involved in the direct production of surpluses and did not develop exploitative relationships over others. Saitta (1994) has proposed that in such contexts, leaders act as communal appropriators of surplus and that the flow of surpluses between elites and producers is "a non-exploitative communally allocated transfer which is granted by producers to elites as compensation for the latter's role in procuring valuables" and services (Saitta 1994:205).

Finally, leadership is also related to demographic scale in two different ways. First, Spencer (1995) has argued that there is a spatial limit to the territory that a regional chief can effectively rule. Large polities imply large distance. Kerr and Jermier (1978: 396) postulate that physical distance creates "circumstances in which effective leadership may be impossible", and the distance generally creates a suppression effect with regard to leadership effectiveness (Bass 1998). The Llanos polities resolved the spatial distance problem in different ways. In Barinas, nucleated settlements were located far away from each other (more than 5 km) and they were

linked by a regional causeway network which was used to connect settlements and mobilize labor and military forces. In Casanare, settlements are highly nucleated and closer to each other (within 2-4 km). The territories of the Casanare polities may, thus have been smaller than those of Barinas, perhaps indicating that the power of emerging leaders of these communities was more limited in comparison with that of Barinas rulers.

Second, for the study of leadership it is also necessary to consider social distance. On one hand, in communities such as those of Barinas with populations in the thousands, the interaction between followers and leaders could be very restricted in time and in context. Lewandowsky and Lisk (2013) have argued that a leader, who is hierarchically distant, infrequent in interactions with their followers, and socially unfamiliar, is susceptible for gaining charismatic attributes (Katz and Kahn 1978). Strategies used by Barinas rulers such as the sanctification of power and the construction of monumental architecture could have reinforced vertical differences between the members of each polity. In that way, social distance could have been a mechanism by which social order was maintained and legitimized by the elites from Barinas (Lewandowsky and Lisk 2013: 24). On the other hand, in Casanare with communities inhabited by just a few hundred people, it is likely that the interaction among followers and leaders was more common and close and in consequence the vertical distance less pronounced. Although there is an incipient segregation of the space expressed through the construction of small habitational mounds, these differences remain small compared with what has been recorded in Barinas. The presence of so few imported objects suggests that the economic differences between rulers and followers were not very pronounced. In such a context, it is likely that followers interacted with close leaders more frequently, evaluating their performance and functional expertise to deal with problems

and situations in which they were directly involved much of the time. In this scenario leadership emergence could be supported over the gain of personal prestige.

The archaeological evidence recovered during the regional survey conducted in the Catanga region thus supports the ethnohistorical accounts of the varying extents of centralized power and the varying strategies used by emerging elites according to the capabilities and the possibilities at the disposal of aspiring rulers in different times and places. The archaeological evidence also shows that these strategies and possibilities were also affected by demography.

In future research, it will be enlightening to evaluate how the variability of the archaeological record in Barinas and Casanare is related to different styles of leadership, the political and economic strategies used by emergent rulers, and the demography in each of those regions. To achieve this goal, research at the community and the household levels will be needed to identify resource consumption patterns, differences in household size, variability in household artifact assemblages, division of labor and specialization, storage capacity and burial patterns. It will also be informative to continue with the regional study of neighboring regions in Barinas and Casanare to delve more deeply into the variability of the complex societies of the Llanos of the Orinoco and the strategies that made possible the emergence of institutionalized leadership.

APPENDIX

ACCESS TO THE ONLINE DATASET

The complete regional dataset for the Catanga Region is available electronically in the Comparative Archaeology Database provided by the Center for Comparative Archaeology at the University of Pittsburgh. This dataset contains both quantitative and spatial information on the individual collection lots that were documented during regional survey, a map of the soil zones that were used in the analyses, along with settlement maps for each phase of prehispanic occupation, which are available in a variety of formats. These data can be downloaded at:

www.cadb.pitt.edu

General questions regarding the database and its contents can be sent to:

cadb@pitt.edu

For specific questions regarding the Catanga Region data, please contact the author directly:

jcv12@pitt.edu

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